

Plasmas: A Fourth Domain of Life? RNA, DNA, Consciousness and Statistical Analysis of “Unidentified Anomalous Phenomena” in the Thermosphere

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Abstract

The data presented here, combined with our previous reports, challenge all conceptions of what constitutes “life,” the origins of life, consciousness, and UAP. Self-illuminated plasmas (AKA plasmoids/UAP), with a nucleus and double cellular layers, engage in complex behaviors in the thermosphere and display multiple forms of communication, mutual awareness, purposeful contact-seeking, and cellular-mitosis and ejection-secretion of interactive plasmoid-clouds and additional plasmoids that contact other plasmas. Plasmas communicate by signaling via oscillations in size and illumination and turn, follow, target and collide, merge or pierce other plasmas, whereas yet others form thick glowing plasma bridges linking multiple plasmoids together; reminiscent of colonies of algae and colliding galaxies and release glowing plasmatic clouds in their wake; reminiscent of a comet’s tail; and upon descending into the lower atmosphere are perceived as UAP/UFOs. Dusty plasmas display mutual awareness, engage in life-like, intelligent behavior, have cellular membranes and a nucleus, and may have generated RNA then DNA via the assimilation of all necessary elements available in space; and fashioned a plasma genome via the incorporation of the genomes of bacteria, algae, fungi, lichens, etc. propelled into the upper atmosphere by bolides, hurricanes and powerful winds; and as such have biological attributes and are alive. Plasmas represent

a fourth state of matter, and it is believed 99% of the universe consists of plasma in various states and which repeat patterns from the micro to macro-levels. Statistical analysis supports all hypotheses and quantifies differential and unique morphological and behavioral characteristics of plasmoids that were filmed by NASA space shuttle missions over 250 Km above Earth. Morphological and behavioral analyses were made of 91 consecutive freeze-frames (T1 - T91) taken every 0.2 s. In addition to distinct and diverse forms of morphology, it was determined that plasmas accelerate to exceptional velocities (up to $35.6 \text{ Km}\cdot\text{s}^{-1}$), and make abrupt 163° turns in trajectory, turn, follow and appear aware of each other. In addition to morphology, four “collision events” were analyzed in detail and all plasmas altered velocity, trajectory, and/or shape either before, during, or after the collision event. Additional analysis revealed what resembles networks and chains of filamentary plasmatic magnetic flux ropes and cables in the thermosphere. These vast plasma macro-tubules and neural networks may be producing plasmoid entities. Ganglia-neural networks may have also been detected in some plasmoid specimens. Plasmaoids have electrical and electromagnetic properties similar to the brain. Macro-tubule plasma flux capable may serve similar functions as micro-tubules, and coupled with behavioral data, support the hypothesis that plasmas/plasmoids are alive and have consciousness.

Keywords

Quantum Physics, Entanglement, Electric Universe, Plasma Physics, Origins of Life, Consciousness, Electric Universe, Electrical Origins of Life, Electromagnetic Nervous System, Horizontal Gene Transfer, Properties of Life

1. Introduction

The data presented here, combined with our previous reports, challenge all conceptions of what constitutes “life,” the origins of life, consciousness, and Unidentified Anomalous Phenomena [1]-[5]. We provide an extensive review of the scientific literature and present pictorial evidence and the results of two major statistical studies in support, including detailed quantitative statistical analysis of Plasmoid behavior and morphology.

Glowing, pulsating, self-illuminated plasmas in the thermosphere engage in complex behaviors and interactions that appear life-like and purposeful (**Figures 1-75**). These interactions include what appears to be communicative signaling via oscillations in size and illumination, with some pulsating relatively rapidly as they approach, and others relatively slowly after they pass other plasmas.

These plasmas are multi-layered electromagnetic cellular entities, up to several Km in size and have been repeatedly observed by NASA space shuttle crews and captured on film by 10 different space shuttle missions engaging in gravity-defying maneuvers and complex behaviors, and approaching and lingering near the

MIR International Space station and a number of space shuttles including appearing outside windows and upsetting the crews [1]-[5]. Plasmoids that descend into the lower atmosphere are likely perceived as UAP/UFOs [2].

Unfortunately, due to the policies of NASA, which added layers of obscuring “noise” to all nighttime film footage and would turn off or redirect cameras when these entities came into view [3], it is impossible to make a precise identification of these specimens. Therefore, we have now twice recommended the launching of an “Alien Hunter Satellite” designed to attract, film, capture and conduct detailed analyses of plasmoids in the thermosphere [1] [2]. Until extensive studies are conducted, and based on the available data, we have chosen to refer to these entities as “plasmas”, “dusty plasmas”, “plasmoids” and “Unidentified Anomalous Phenomenon.”

As detailed dusty plasmas may have provided the internal environment for the genesis of RNA then DNA and the origins of life via the assimilation of all the necessary elements which are available in space; and may have fashioned a plasma genome via the incorporation of the genomes of bacteria, algae, fungi, lichens, etc. propelled into the upper atmosphere by bolides, hurricanes and powerful winds.

We also hypothesize that plasmas engage in complex behavior because they are alive and sentient and represent a fourth domain of life. A review of the relevant scientific literature and a quantitative analyses of plasmoid behavior, size, movement, velocity, and contact seeking supports these hypotheses.

We also report the discovery of what resembles extensive networks of plasmodic magnetic flux tubes, ropes and cables in the thermosphere that, to speculate, may be giving birth to or providing energy to plasmoids (**Figure 59 & Figure 60**); and which may function similarly to a virtual electromagnetic nervous system.

2. Electromagnetic Extremophiles: “Hunters”, “Grazers”, “Floaters”, “Thunderstorm Divers”

Some plasmas appear to behave as if they are swimming in water, or rather, in a sea of electricity [6]-[15]. It has also been noted that plasmas in the thermosphere, and their behaviors and multi-plasma cellular composition, bear similarities to water dwelling algae, diatoms and dinoflagellates [3] [5] [16].

Carl Sagan [17] hypothesized that algae-like organisms, kilometers in size are dwelling in the atmospheric seas of Jupiter. He proposed four kinds of organisms: “primary photosynthetic autotrophs (“sinkers”); larger autotrophs or heterotrophs (“floaters”); organisms that seek out others (“hunters”), and organisms that live at almost pyrolytic depths (“scavengers”).” Sagan concluded “that ecological niches for sinkers, floaters, and hunters appear to exist in the Jovian atmosphere.”

It has been proposed that plasmas of the thermosphere could be classified as “Hunters”, “Grazers”, and “Floaters” [16] whereas “Sinkers” could be likened to “Thunderstorm Divers” that descend into thunderstorms and the lower atmosphere where they are likely to be classified as UAP/UFOs [1] [2]. As documented here: plasmas in the thermosphere engage in intersections similar to algae (**Figures 28-30**).

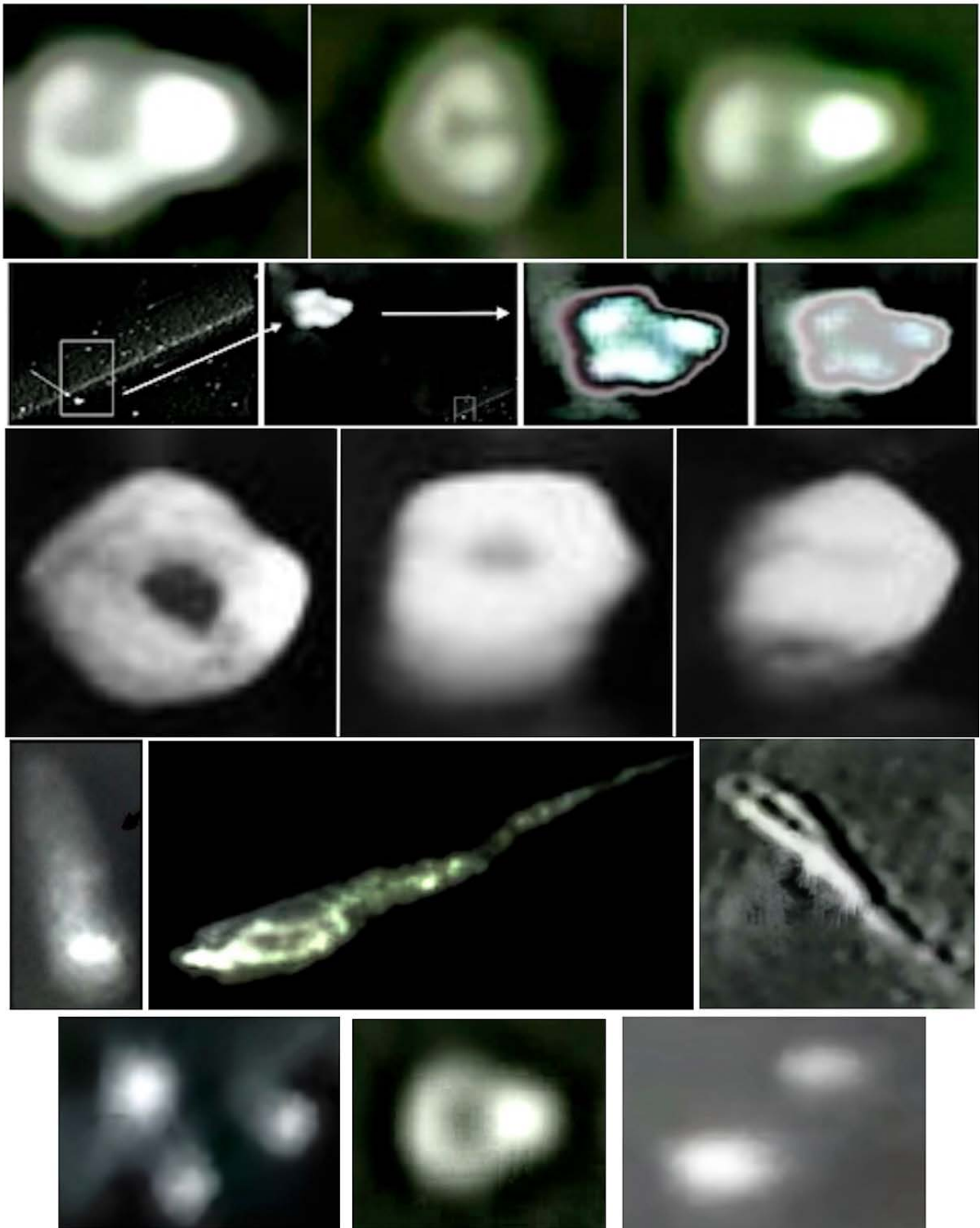


Figure 1. Plasmoids of the thermosphere may include different species as they have a variety of shapes and sizes and engage in different behaviors.

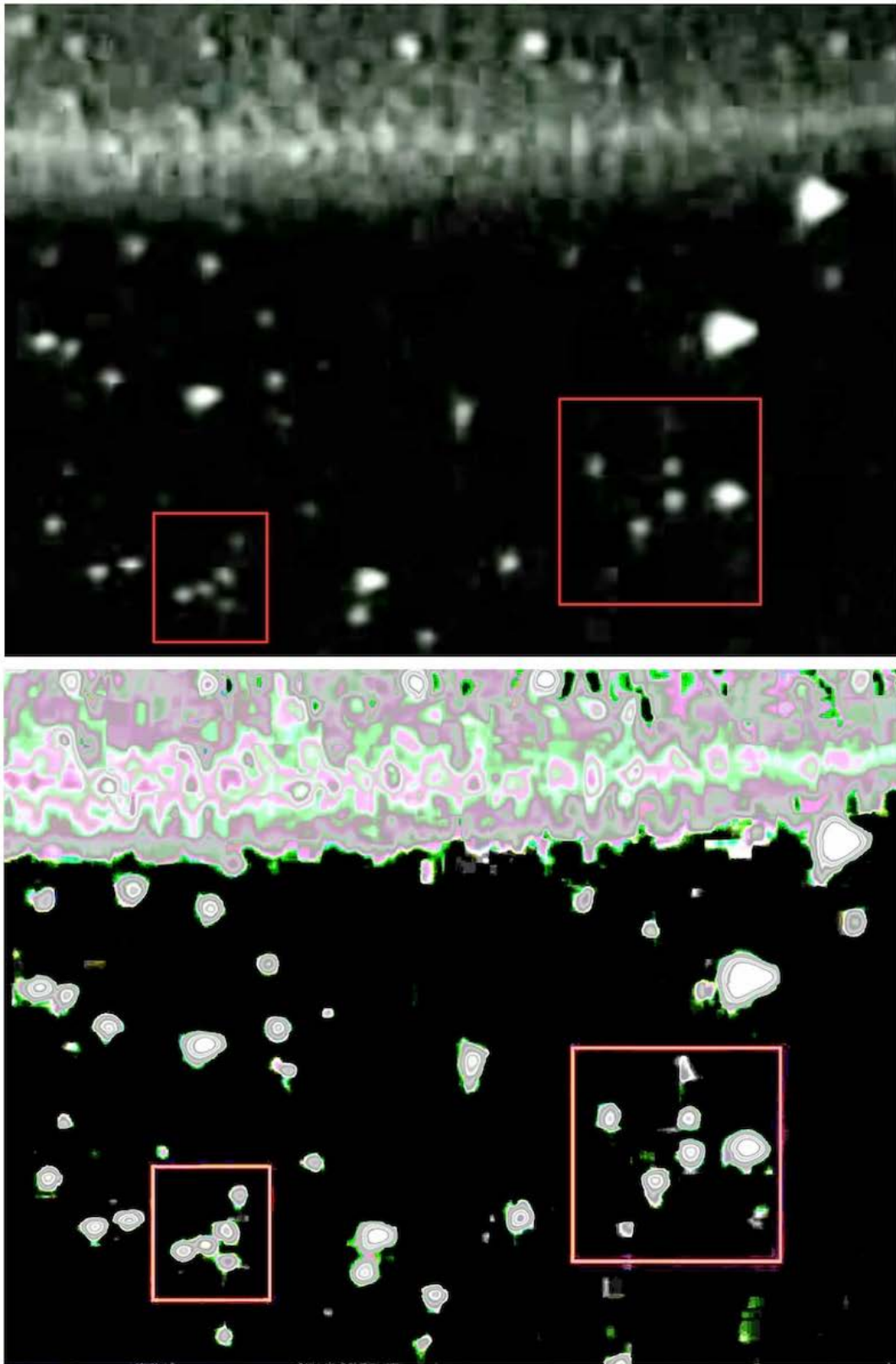


Figure 2. Hundreds of cone- and cloud-shaped glowing plasmas with multiple layers and an internal nucleus filmed congregating 200 miles above Earth. Film by STS-80. Many form electromagnetic-plasma bridges linking multiple plasmoids. (Bottom). Processed via Fotor software designed to detect and colorize differences in pixel gray scales.

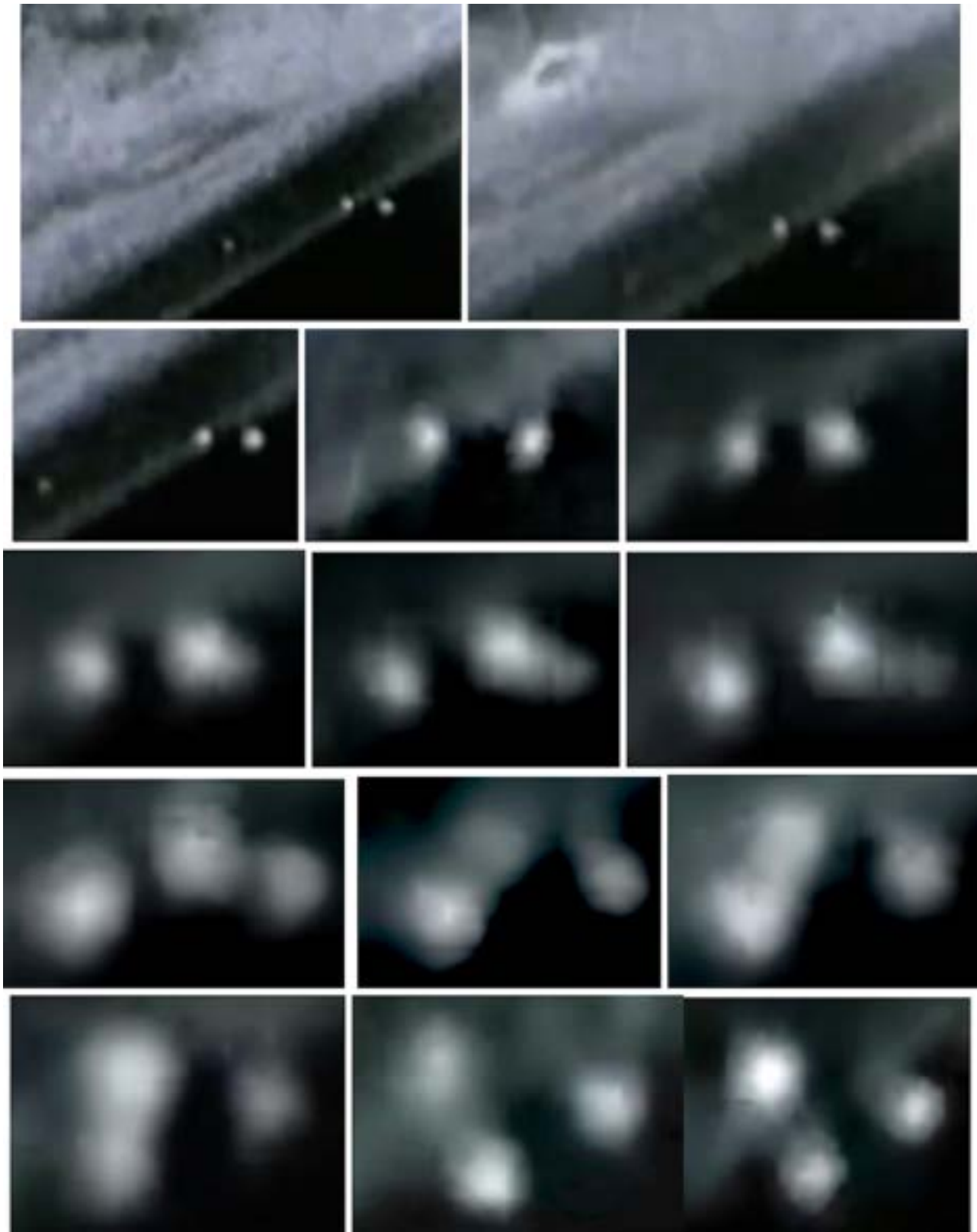


Figure 3. Two glowing shape-shifting plasmoids (near a thunderstorm), one of which (far right) becomes elongated. A third plasmoid emerges from the plasma on the right which makes contact with the plasmoid on the far left, and then detaches, such that two plasmoids become three. (See also **Figure 19**).

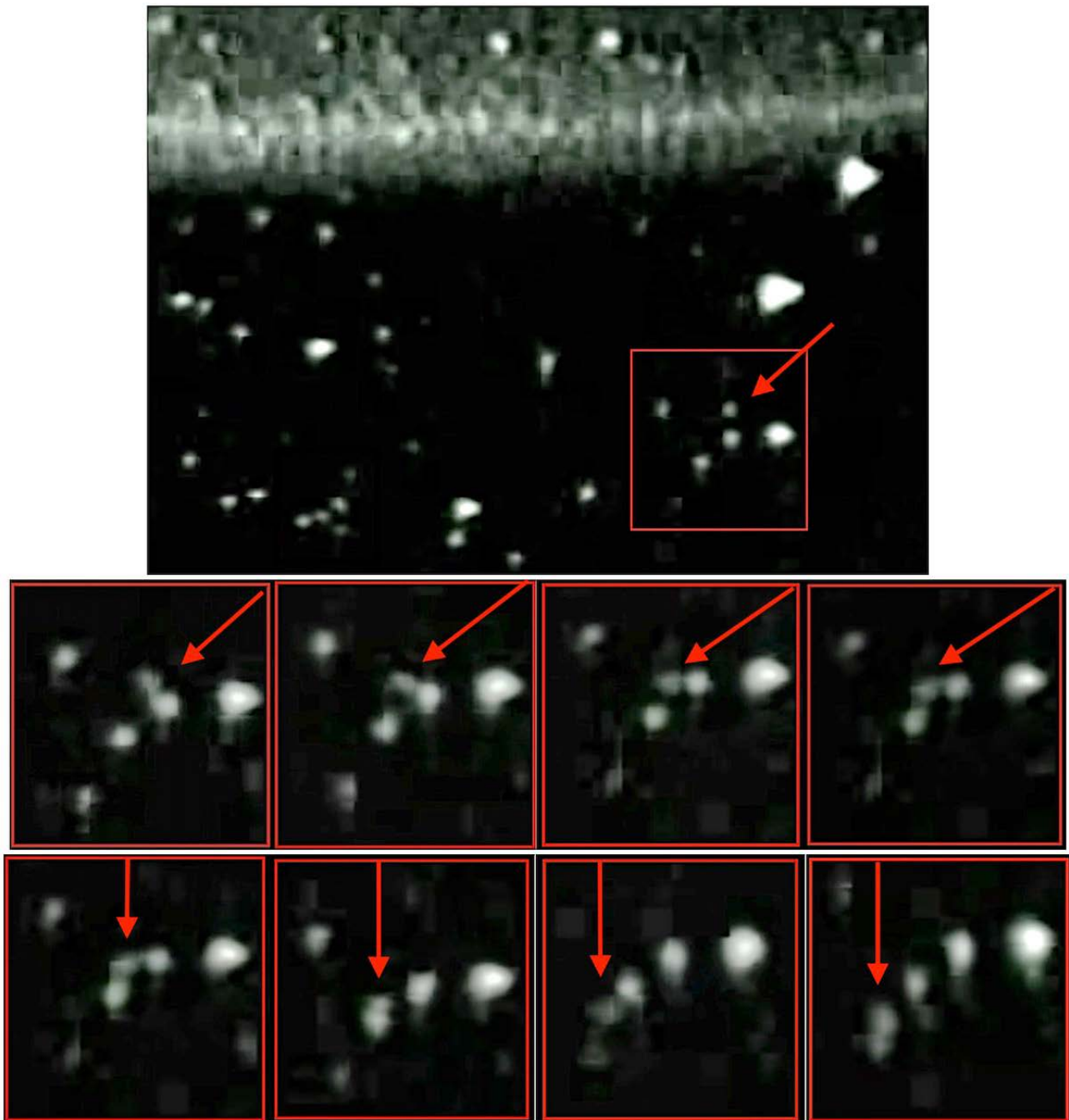


Figure 4. Freeze frames from a film by STS 80, the crew of which misidentified three different plasmas as the MIR International Space Station and then NASA to turned off the Camera. As depicted here: a single plasma contacts first one, then changes into an arc-like direction and contacts three additional plasmas in sequence. These images are reminiscent of colliding galaxies, binary stars, and interactions with pulsars. (Top Figure): The “cone” shape of some of the larger plasmas may be due to a phenomenon known as magnetic reconnection, where the magnetic fields form a neutral cone-shaped “saddle point.” Because these large plasmoids are oriented toward the sun, the solar magnetic field passes all around them. Consider the magnetosphere, which has a toroidal cone shape due to bending and curving of its magnetic field; the degree of curvature is proportional to the strength of the current.

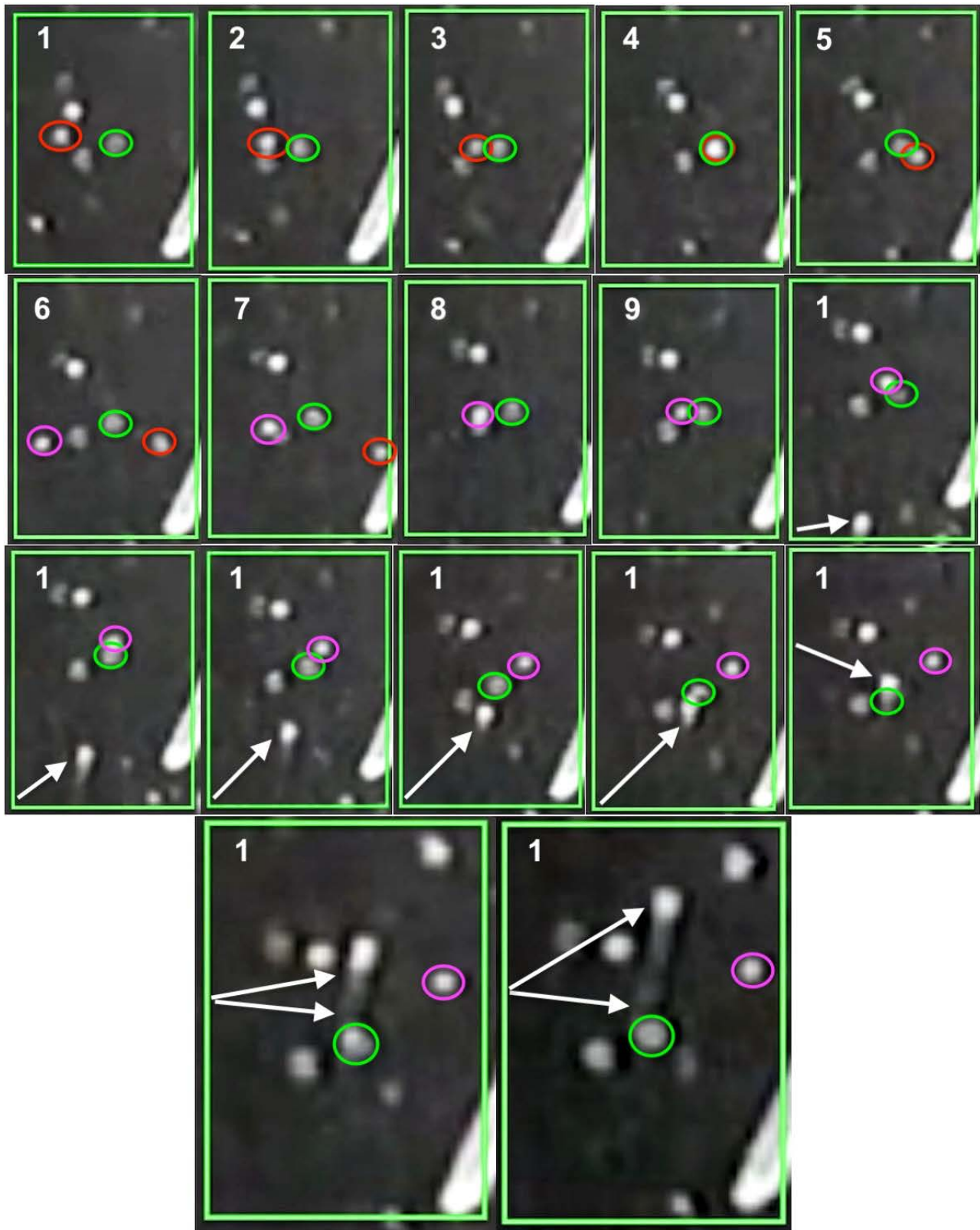


Figure 5. Three different plasmoids target and contact the plasma circled in green. Note plasma dust trail left in the wake of the last colliding plasmoid (white arrows). Freeze frames from STS 75 film.



Figure 6. A. plasmoid leaves a plasma-cloud trail after piercing plasma at the bottom, then arcs toward the right and contacts the donut-shaped plasma and again alters its direction of trajectory and leaving a plasma trail in its wake. From STS 75.

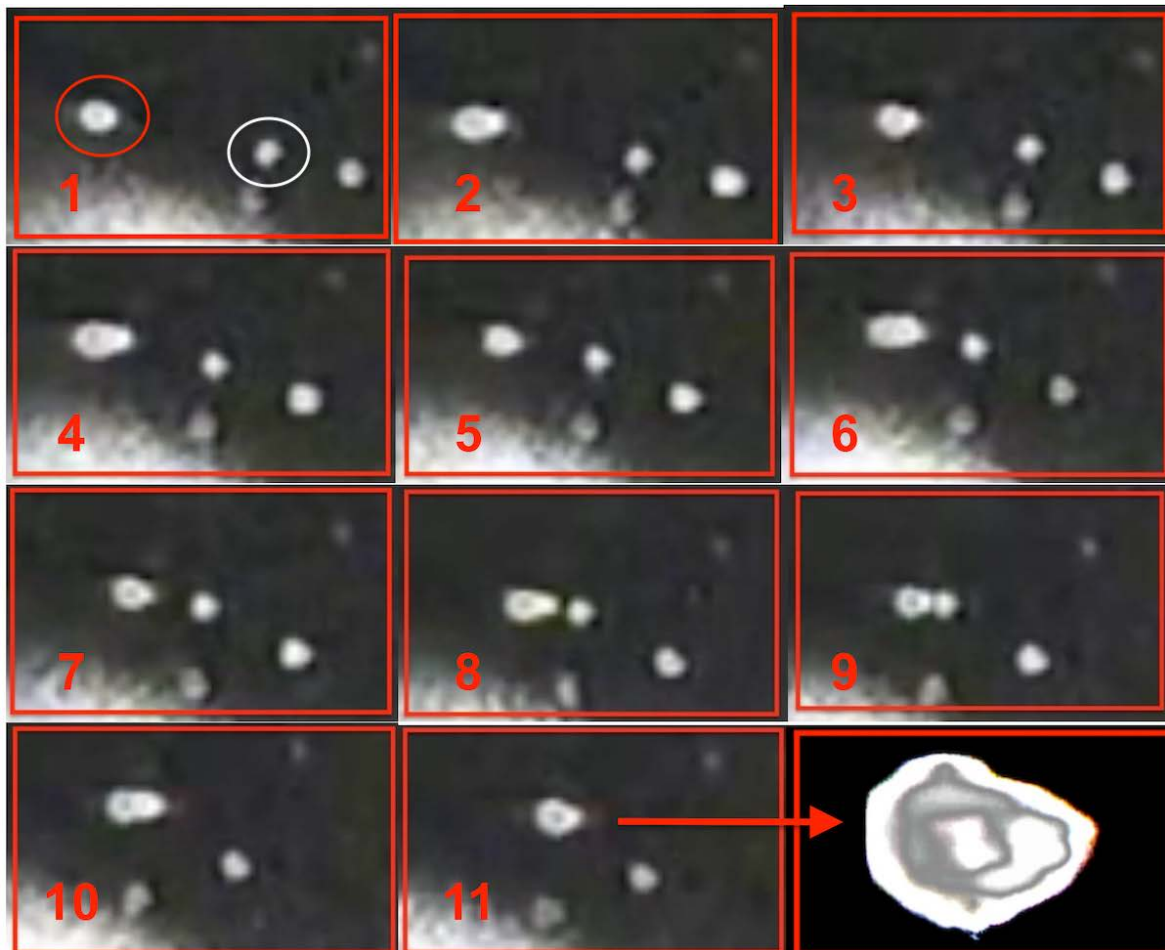


Figure 7. The plasma circled in red waxes and wanes in size as it approaches the plasma circled in white. Often, plasmas will move into a position where they wait to be intersected by another plasmoid as documented in these “freeze frames” from STS 75 film footage. The final image depicts internal features resulting from the merging of these two plasmoids (processed by Fotor software to identify differences in pixel gray scales).

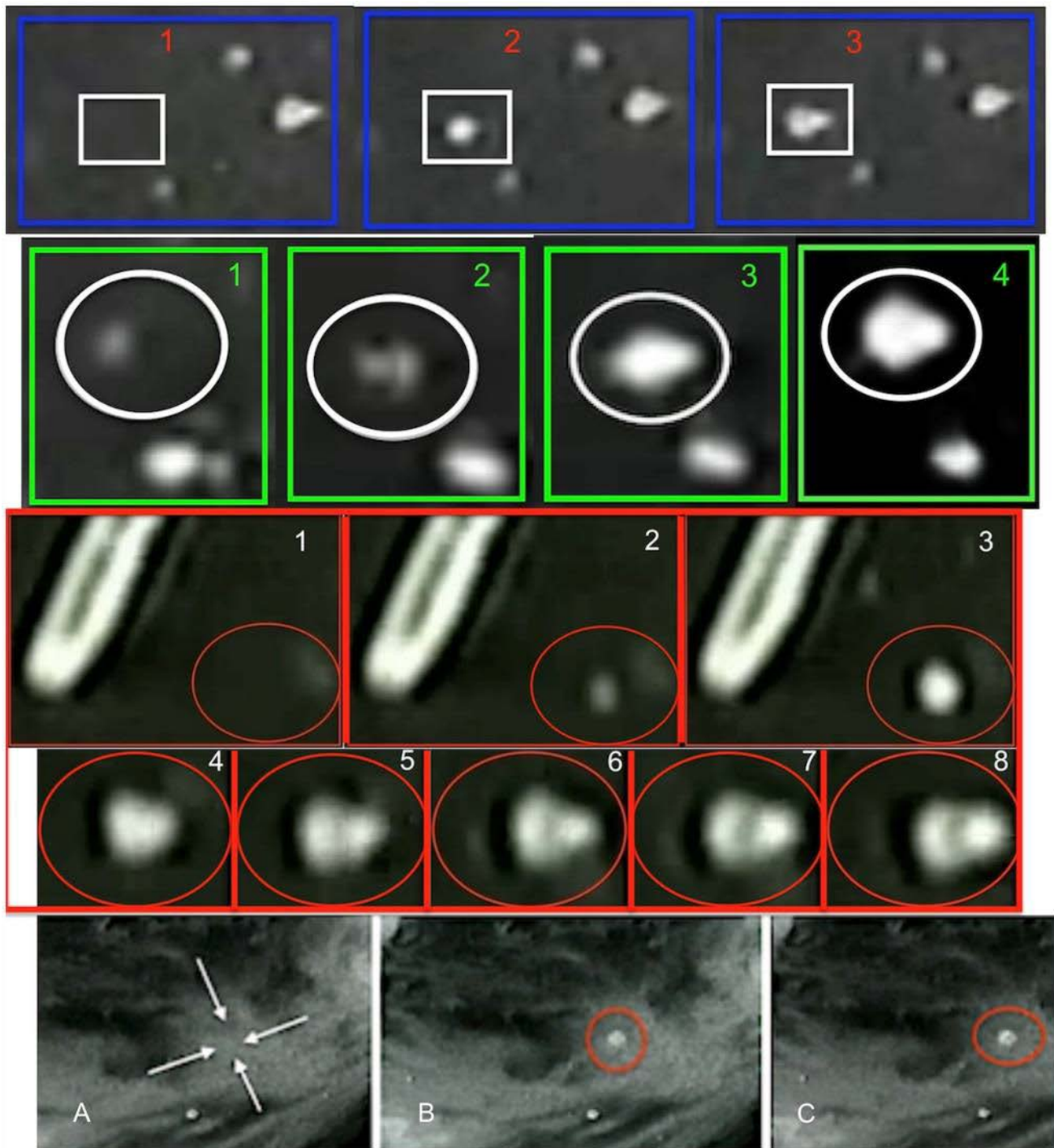


Figure 8. Examples of how plasmoids will suddenly materialize and grow in size. In some instances, they appear to emerge from a black-hole in spacetime; though it is equally possible they were in a dark mode and began self-illuminating. Often, but not always, they assume a cone shape; and like all con-shaped plasmas, they are oriented toward the sun, or where the sun will appear. This may be due to magnetic reconnection, where the magnetic fields form a neutral cone-shaped “saddle point” as the solar magnetic field passes all around them.

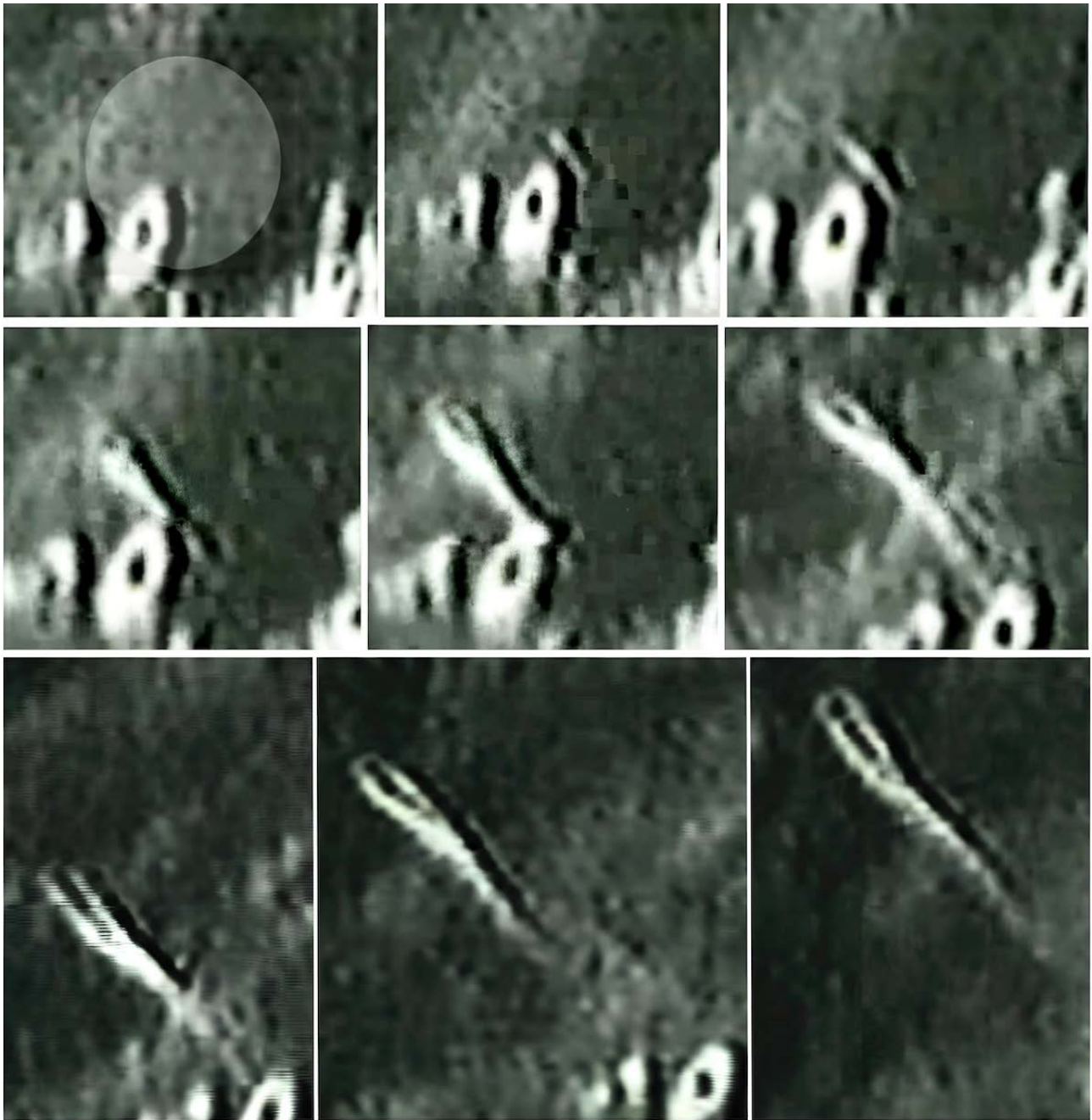


Figure 9. Serpentine plasmoid materializing and growing in size as it “snakes” toward a thunderstorm. Filmed by STS 80.

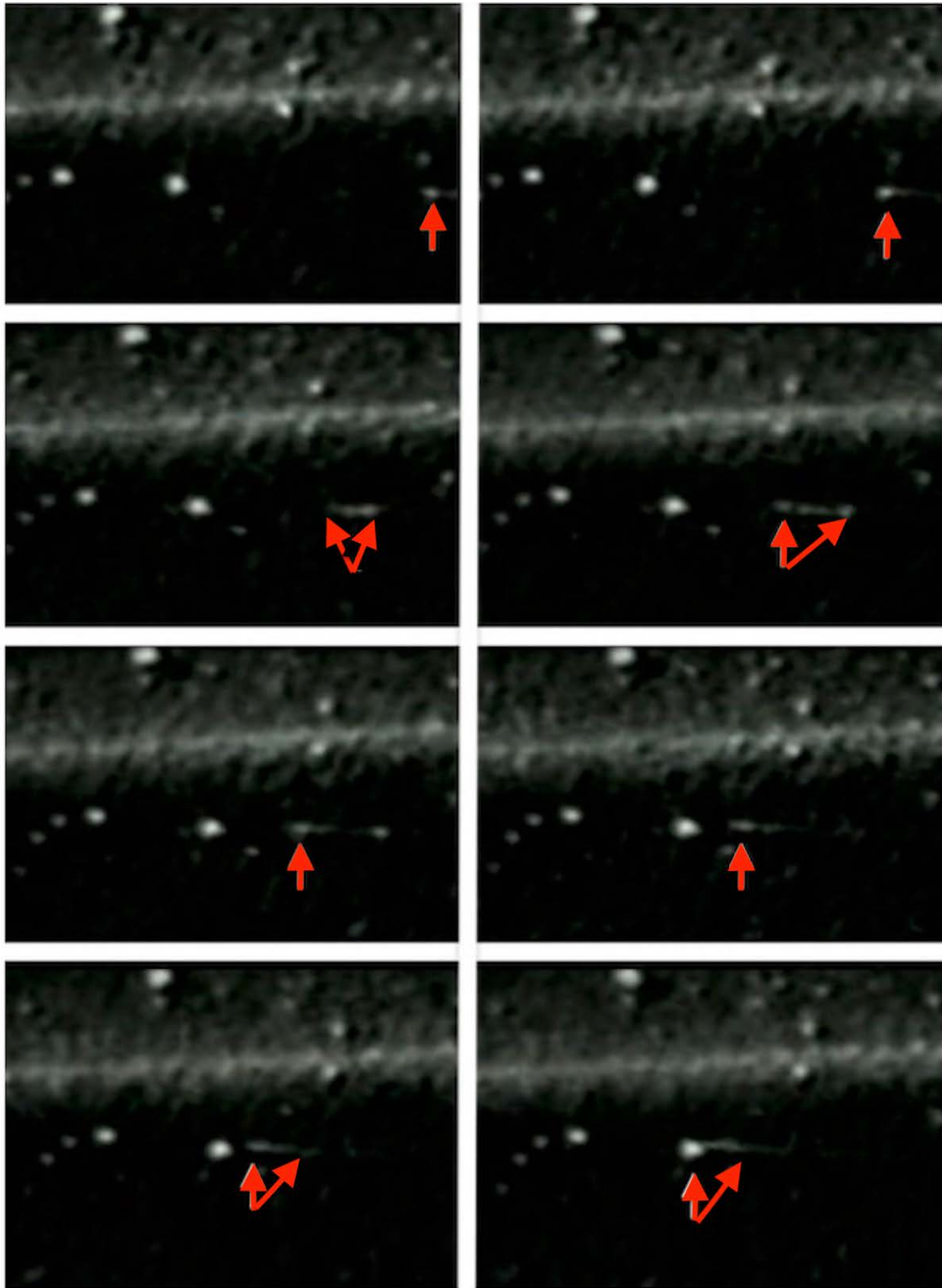


Figure 10. Serpentine Hunter targets, strikes, and pierces numerous plasmas (see **Figure 11** & **Figure 12**), including a cone-shaped plasmoid that materialized, grew in size and maneuvered into a location making it a target (see **Figure 13**).

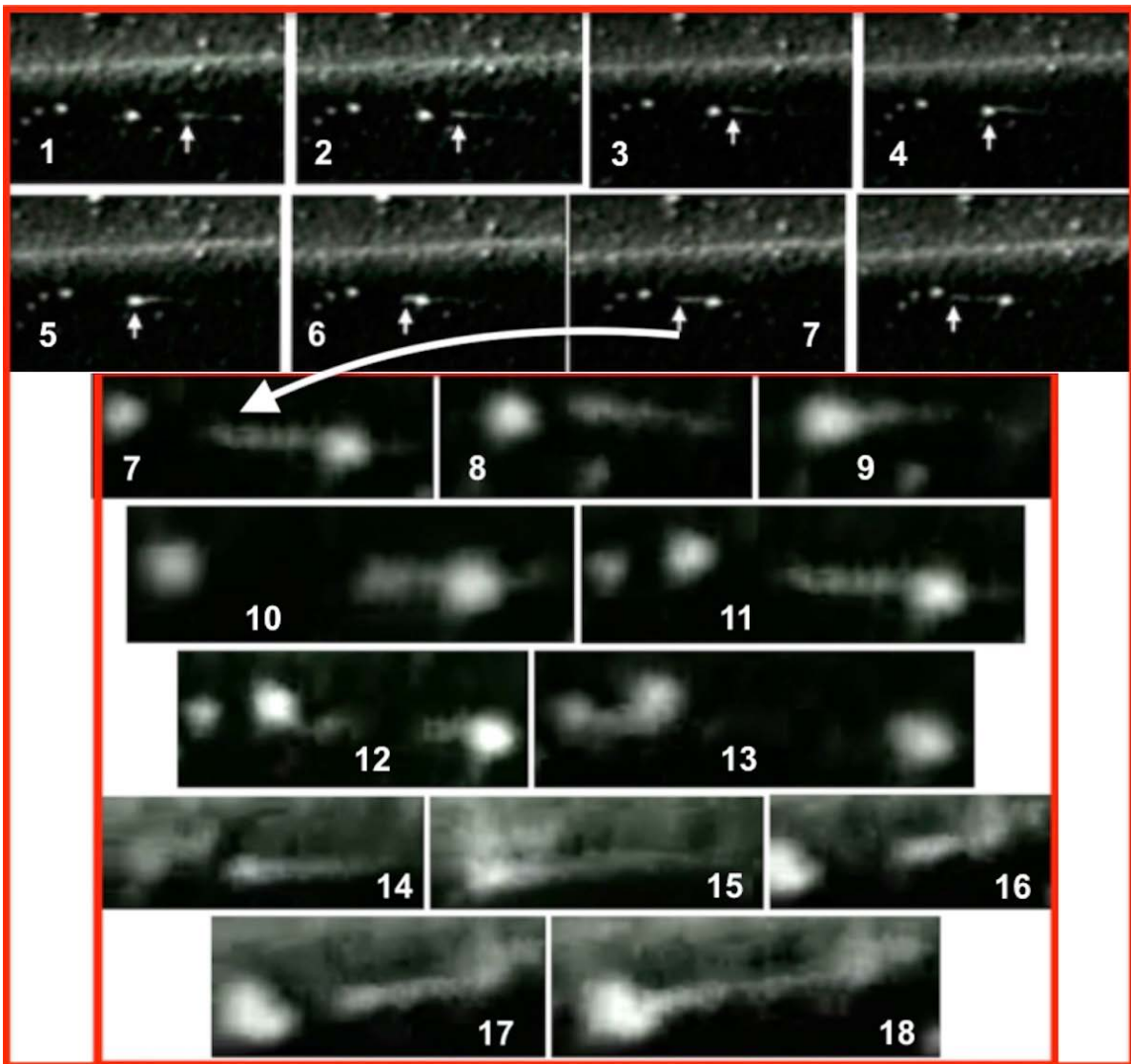


Figure 11. Serpentine plasmoid (depicted in **Figure 10**, **Figure 12**, **Figure 14**) continues to snake through the thermosphere, changing its trajectory-orientation, its “tail” waxing and waning in length, as it hunts and strikes and pierces numerous plasmoids, including a cone-shaped plasmoid that materialized, grew in size and maneuvered into a location making it a target (see **Figure 13**).

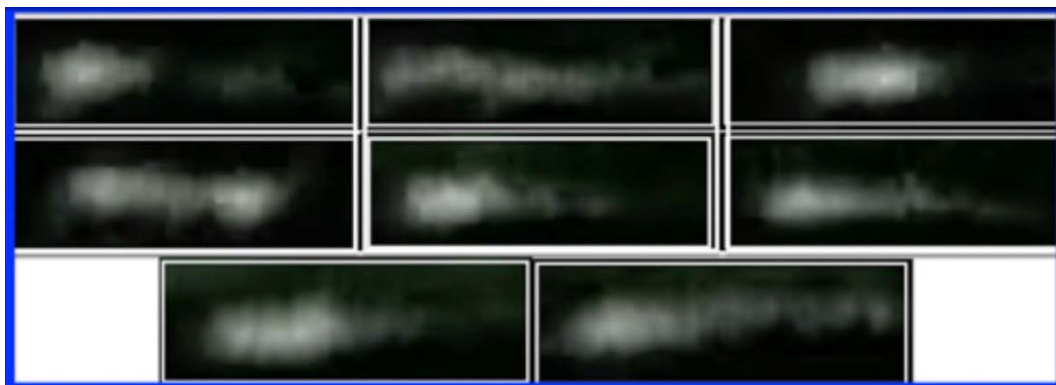


Figure 12. Cloud-like serpentine plasmoid (depicted in **Figure 10**, **Figure 11**, **Figure 13** & **Figure 14**) waxing and waning in length, and shedding cloud-like plasmoids as it hunts.

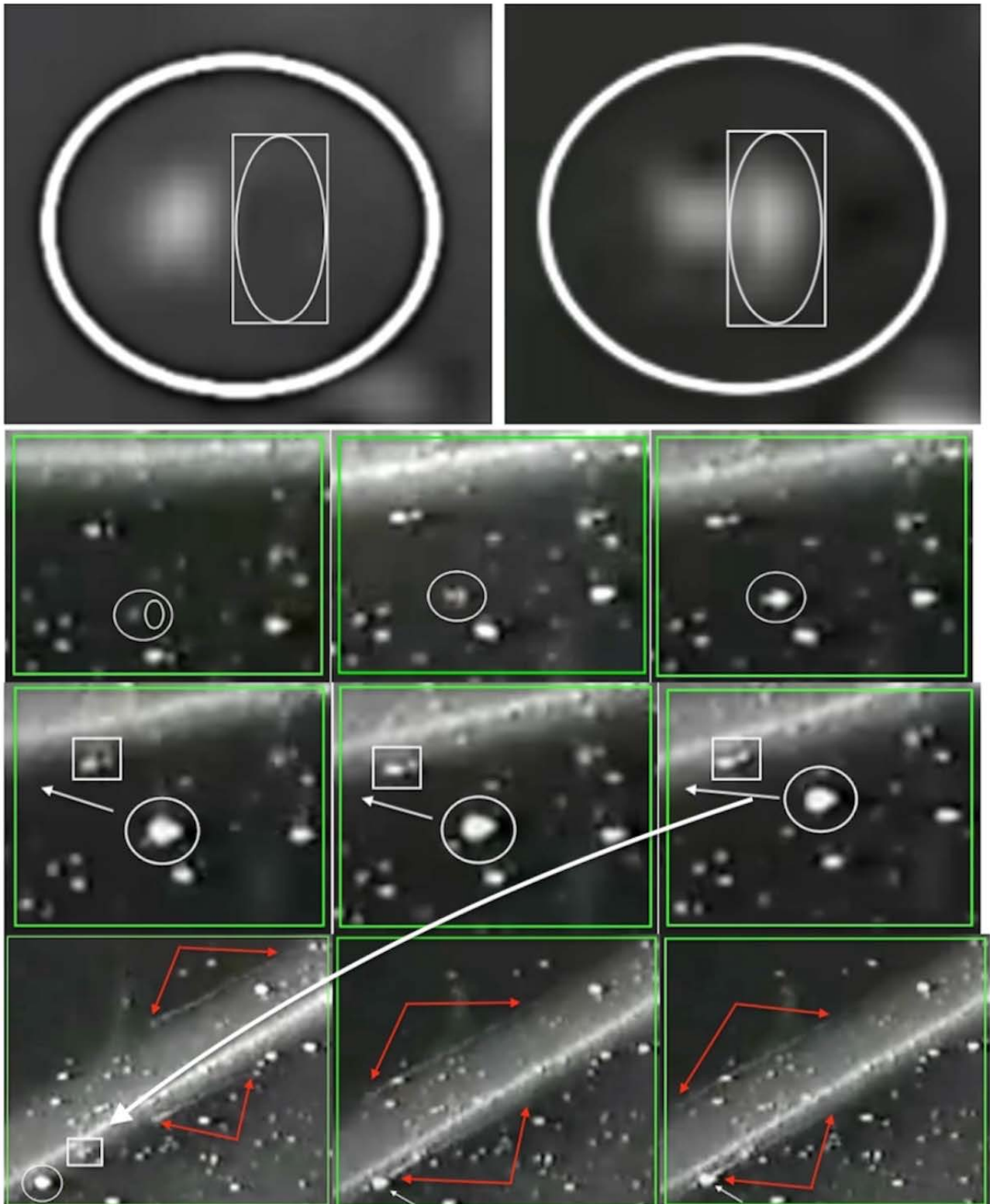


Figure 13. Plasmoid suddenly materializes, merges with another plasmoid, increases in size and navigates into the direct path of a serpentine Hunter (see **Figures 10-12, Figure 14**) and which is accompanied by another plasmoid that hunts in parallel. Filmed by STS 80.

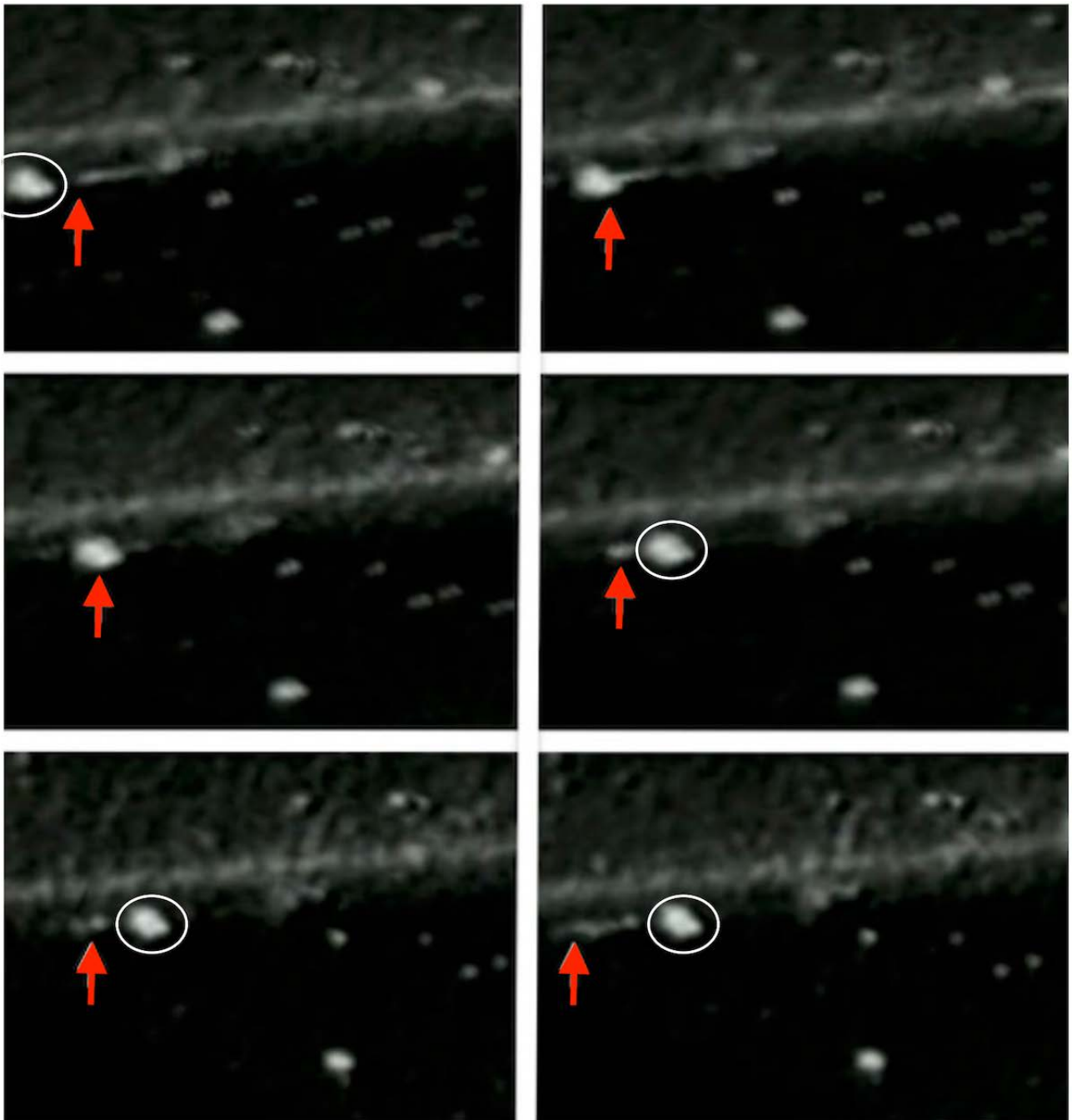


Figure 14. Plasmoid that had suddenly materialized and grew in size (**Figure 13**), maneuvered into the direct path of a serpentine Hunter (see **Figures 10-13**) where it hovered in place until struck and pierced.

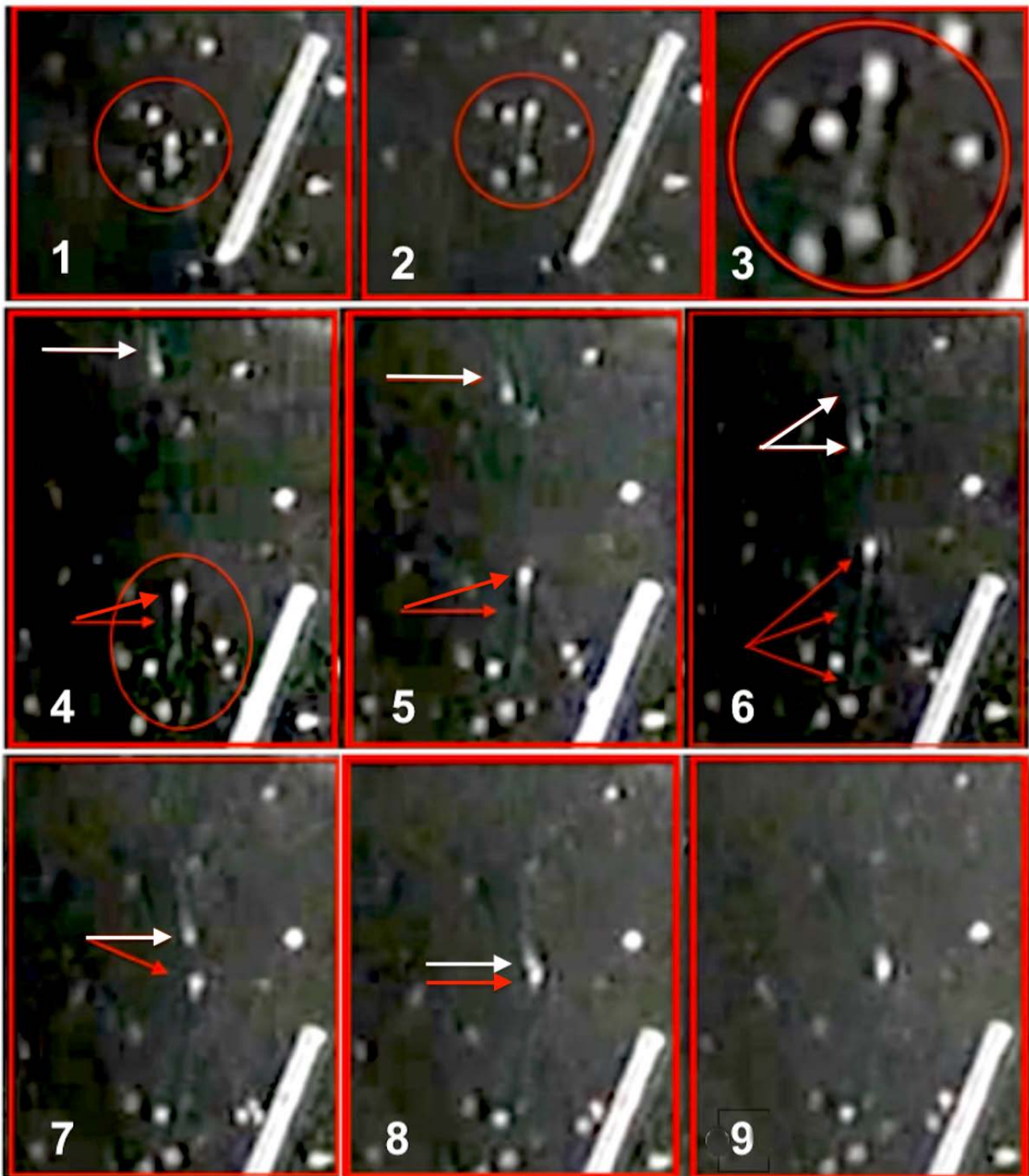


Figure 15. Collisions and streams of cloudy particles in the wake of two approaching plasmas as they collide and merge. Filmed by STS 75. (Continued in **Figure 16**): After they collide and pierce each other, both shed clouds of plasma in their wake, a phenomenon reminiscent of comets as they soar through the heavens.

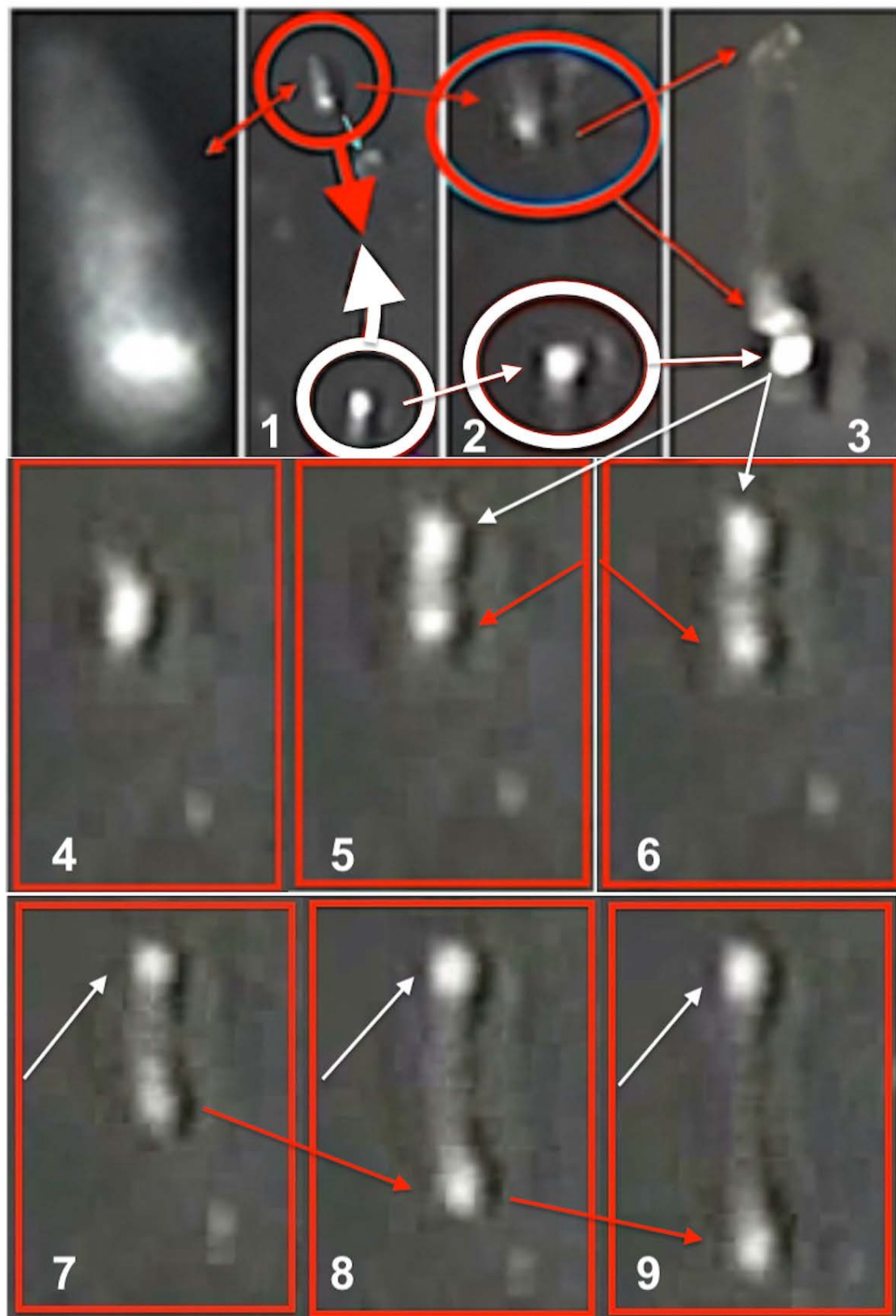


Figure 16. STS 75. Complex behavior and interactions including secreting/ejecting clouds of plasmas before and after colliding and piercing each other (see **Figure 15**). Freeze frames from STS 75 film.

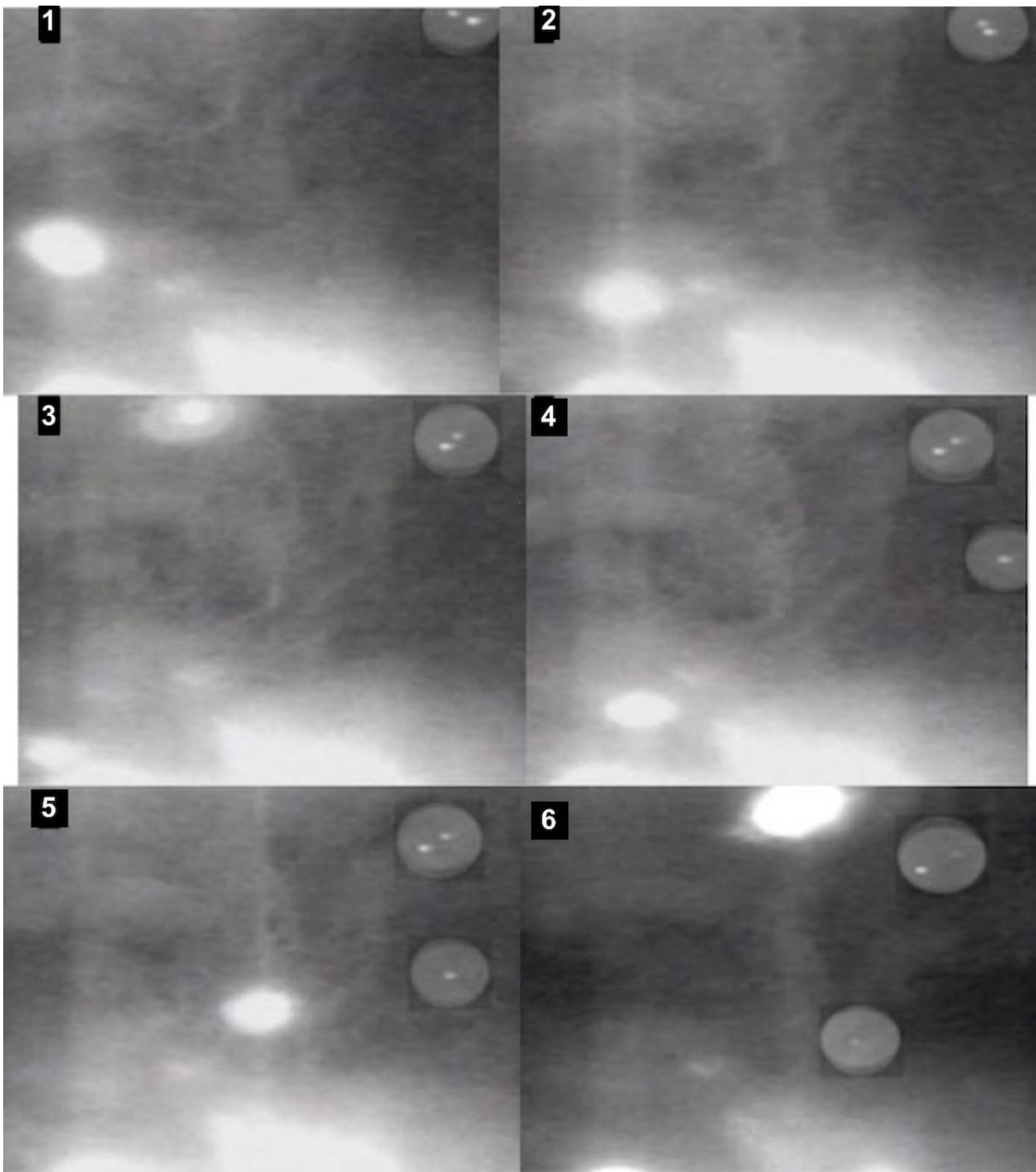


Figure 17. Cloud and conical shaped plasmoids in the thermosphere approaching a violent thunderstorm raging 200 miles below. Filmed by STS 96.

3. Plasma Mitosis, Replication, Reproduction, Shape-Shifting, and Complex Communicative Behaviors

It has been documented [1]-[5] that these self-illuminated plasmas of the thermosphere have a variety of shapes, e.g. cloud, cone, ring, donut, serpentine (**Figure 1**), oscillate in size and illumination (**Figure 8, Figures 23-27**), will suddenly materialize and grow in size (**Figure 8, Figure 9, Figure 13** speed up and slow down and commonly make gradual or sudden and rapid 45, 90, 180 degree turns (**Figure 22**) and will follow or collide or pierce other plasmas (**Figures 3-7, Figures 11-13**); the collisions often associated with the release of Km in length cometary-like plasma trails just prior to or following collisions (**Figures 13-16**).

Some plasmas in the thermosphere also consist of conglomerates of multiple plasmas (**Figure 28**); and in actions reminiscent of cellular mitosis, some will divide and replicate or secrete-eject plasmoids that follow, confront, contact and interact with other plasmas (**Figure 3**). In addition, some plasma merge with and/or form networks of plasma links with other plasmas (**Figures 2, Figure 19, Figure 29**); reminiscent of algae (**Figure 28, Figure 30**) as well as binary stars and colliding galaxies; “collisionality” being a common plasma behavior in the thermosphere (**Figures 5-7, Figures 10-16**). Hence, these observations may be examples of how patterns repeat in nature and throughout the universe [18]-[25].

Plasmas in the thermosphere often target and collide sometimes head-on with another plasmoid such that two rapidly moving plasmoids appear to purposefully seek out each other (**Figures 3-5, Figure 8, Figure 15 & Figure 16**) Not uncommonly, one or both will eject, in their wake, a cloudy illuminated stream of (A) plasma particles and dust or (B) smaller plasmoids prior to or following the collision [1] [2].

In some instances, a plasmoid that is being followed will also eject, in their wake, a smaller plasmoid that will target the plasma that is following. This ejected mini-plasmoid will strike and/or just prior to collision, cause the plasmoid that is following to suddenly reverse direction! Hunters will also sometimes eject a plasmoid replicon in their wake, and sometimes the replicon will remain relatively stationary (like a Floater) as the Hunter continues to hunt [1]-[5].

Some plasmoids will also merge for several seconds before moving on. Not uncommonly, a cloud of plasma will briefly connect two merging or mutually contacting plasma, just before they make contact and as they disconnect [1]; perhaps reflections of electromagnetic interactions. Yet others will form multi-plasma bridges that link them all together. Whether these are purely electrical exchanges or evidence of purposeful social behavior is unknown.

Plasma will also change from a dark mode to illuminated, or from illuminated to dark mode. Yet others will suddenly materialize and grow in size as they change shape. Commonly, plasma changes shape and size as it moves through space or approaches another (**Figure 18**).

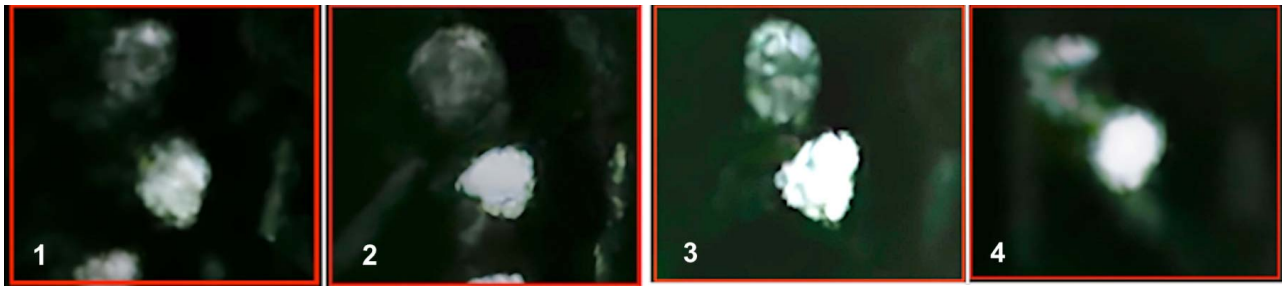


Figure 18. Sequential photos from STS 75. Shadowy shape-shifter approaches plasma Floater. Both increase illumination as they draw near and make contact. The extreme shape shifting of the approaching plasma is reminiscent of the shape-shifter filmed by a U.S. Customs and Border Protection DHC-8 over the ocean and coast of Aguadilla, Puerto Rico [2]

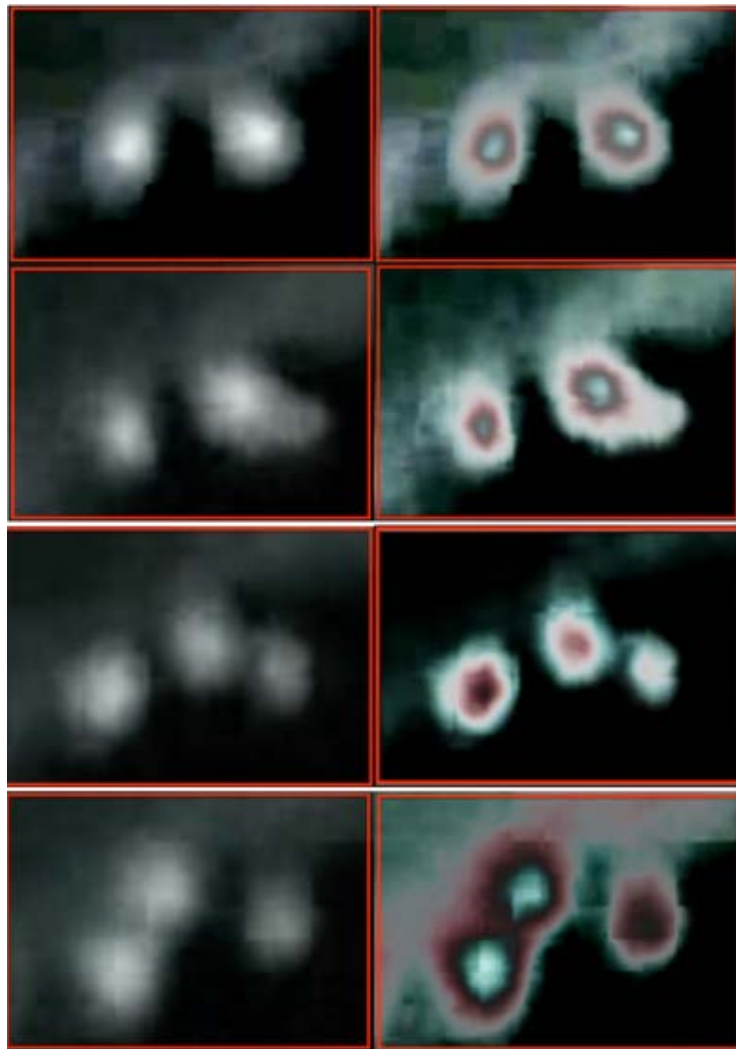


Figure 19. In this sequence, two plasma, Floaters, similar in cloud-like shape, with glowing nuclei at their center, remain adjacent without moving. The plasma to the right undergoes mitosis, the smaller portion remains behind as the larger, detached portion moves toward the plasma to the left (see also [Figure 3](#)). The detached plasma has a glowing nucleus, whereas its “parent” plasma no longer has a nucleus. The detached plasma travels to the left and makes contact and merges with the other plasma that also has a glowing nucleus. What is the meaning of these complex interactions? Is it purposeful and under “intelligent control?” Is this a form of “horizontal information exchange?” A form of alien mating? Perhaps the two merging plasmas have an attractive charge, the interactions are electromagnetic and guided by as yet unknown principles of plasma physics.

4. Lower Atmospheric Encounters with Plasmoids UAP/UFOs

Langmuir [6]-[8] and other investigators report that plasma created in a laboratory engage in life-like purposeful behaviors and complex interactions, including tracking, merging, and colliding (sometimes referred to as “collisionality” and “energy cannibalism”). Identical behaviors have been observed in the thermosphere [1]-[5] [16]. Navy pilots, who observed and filmed these plasma-like forms, claimed these entities display intelligence and an awareness of their surroundings.

Plasmas in the thermosphere approach and congregate near sources of electromagnetic activity including an electrified tether generating electromagnetic pulses into the space medium and above thunderstorms (**Figure 17**, **Figure 22**), where many will approach, pierce, merge and pass by each other [1]-[5]. They also approach these storms at varying speeds, only to slow down as they descend into the storm without burning up (**Figure 17**). Yet others will ascend from thunderstorms and hurricanes back into the thermosphere and may pace or follow or approach the space shuttles [1]-[5] [16].

These plasmas are electromagnetic entities and are obviously attracted to sources of electrical activity. It has been hypothesized that plasmoids which have descended into the lower atmosphere account for many observations of UAP/UFOs, especially those seen above nuclear power plants and nuclear-powered ships and sites of nuclear disasters and explosions [1] [2]; a thesis that challenges all traditional extraterrestrial explanations; provides a scientific framework for understanding some phenomena associated with UAP and which effectively ties together atmospheric science (e.g. thunderstorms, lightning, atmospheric charging and white water ocean conditions) with observations of UAP from Navy pilots and as based on U.S. Navy film footage. It is now well documented that some UAPs exhibit complex behaviors akin to those typical of plasmoids in the thermosphere and may be responsible for what is referred to as “inexplicable” airline disasters [2].

The fact is: These entities (AKA UAP/UFO) once they descend into the lower atmosphere and like those in the thermosphere [26]-[41], display no means of propulsion, make “impossible turns,” approach and nearly collide with aircraft, and can suddenly accelerate to gravity defying hyper-velocities and disappear into the upper atmosphere [37] [38]. This is typical plasma behavior in the thermosphere, and characteristic of plasmas (AKA UAP/UFOs) in the lower atmosphere [26]-[41] as documented by Navy pilots Ryan Graves and David Fravor in prepared statements for the United States Congressional Oversight Committee [40] [41].

For example, Ryan Graves reported [40]: “I have witnessed UAP on multiple sensor systems firsthand... They were a common occurrence, seen by most of my colleagues on radar and occasionally up close. The sightings were so frequent that they became part of daily briefs.... A pivotal incident occurred during an air combat training mission in Warning Area W-72, an exclusive block of airspace ten miles east of Virginia Beach. All traffic into the training area goes through a single

GPS point at a set altitude. Just at the moment the two jets crossed the threshold, one of the pilots saw... a clear sphere—motionless against the wind, fixed directly at the entry point. The jets, only 100 feet apart, were forced to take evasive action... The UAP we encountered and tracked on multiple sensors behaved in ways that surpassed our understanding and technology. The UAP could accelerate at speeds up to Mach 1, hold their position against hurricane-force winds, and outlast our fighter jets, operating continuously throughout the day. They did not have any visible means of lift, control surfaces or propulsion—nothing that resembled normal aircraft with wings, flaps or engines. I am a formally trained engineer and I have no explanation for this... Pilots are reporting UAP at altitudes that appear to be above them at 40,000 feet, potentially in low earth orbit or in the grey zone below the Karman line, making inexplicable maneuvers, like right hand turns and retrograde orbits, or j-hooks... I have met with highly credible commercial pilots at major airlines with decades of experience, often veterans, who describe UAP operating at altitudes that appear to be above them... potentially in low earth orbit..."

And just as plasmoids in the thermosphere commonly follow, target and collide with each other, Navy pilots have reported numerous encounters where they had to take evasive action to avoid collisions with UAP which more often than not, have an oval form and change shape (**Figure 20**) and possibly internal layers similar to plasmoids (**Figure 20**). According to Graves [40]: "The UAP Task Force reported in 2021 that there were 11 near misses with UAP and I understand that number has grown." In an earlier report, it has been documented that increased sightings of UAP also correspond with increased incidents of inexplicable aircraft disasters—a function possibly due to plasma induced electronics failure and mental disturbances, and/or head-on collisions [2].

It is well documented that encounters with these plasmoid-like UAPs can short out electronics, radar, and autopilots reported by Graves and others, including, according to David Fravor: "jamming of the APG-73 radar in the aircraft." The disruption of electronics is predictable given that plasmoids are electromagnetic entities that are attracted to and emit electromagnetic radiation (REF).

As reported in U.S. Congressional testimony [41]: David Fravor, a former Navy commander, and a graduate of the Top Gun naval flight school, was commander of an F/A-18F squadron on the USS Nimitz on November 14, 2004 about 100 miles southwest of San Diego, when advanced radar on the USS Princeton detected "multiple anomalous aerial vehicles" over the horizon and descending 80,000 feet in less than a second. According to Fravor [41]: "The air controller on the ship... had been observing these objects on their Aegis combat system for the previous 2 weeks. They had been descending from above 80,000 ft and coming rapidly down to 20,000 ft, would stay for hours and then go straight back up.

Fravor and another pilot, Dietrich, diverted to investigate [41]. That's when he and Dietrich spotted the UAP. "I said, 'Dude, do you, do you see that thing down there?' And we saw this little white Tic Tac-looking object. And it's just kind of

moving above the whitewater area.” Fravor reported that he and three fellow military pilots all observed the white oval-shaped object: “There were no Rotors, No Rotor wash, or any visible flight control surfaces like wings.... the object suddenly shifted its longitudinal axis, aligned it with my aircraft and began to climb in a clockwise climbing turn...” And then suddenly it rapidly climbed about 12,000 feet in the air and approach his fighter jet and for the next five minutes it was mirroring his jet’s movements, leading Fravor to conclude: “it was aware we were there... And then it rapidly accelerated and disappeared right in front of our aircraft... air controller let us know that the object had reappeared on the Princeton’s Aegis SPY 1 radar at our CAP point. This Tic Tac Object had just traveled 60 miles in a very short period of time (less than a minute), was far superior in performance to my brand new F/A-18F and did not operate with any of the known aerodynamic principles that we expect for objects that fly in our atmosphere...and does not emit any IR (infrared) plume from a normal propulsion system that we would expect.... As summed up by Fravor [41]: “What we experienced was well beyond the material science and the capabilities that we have currently or that we’re going to have...”

It can be predicted that plasmoids (AKA UAP/UFOs) observed by Navy pilots defy “material science” because Plasmas obey the laws of electrodynamics and are not bound by technology or gravity [27].

5. Gravity Defying Electromagnetic Activity

A plasma is a collection of negatively charged electrons and positively charged ions and is an excellent conductor of electricity; whereas the electric force between two ions is many orders of magnitude stronger than gravity [27]. In fact, the electrostatic repulsive force between two protons is 36 orders of magnitude greater than gravitational attraction; and the repulsive force between two electrons is 42 orders stronger; whereas the attraction between an electron and a proton is 39 orders of magnitude stronger than gravity. Combined, these plasmodic electromagnetic forces are one thousand trillion trillion trillion (10^{39}) times stronger than the gravitational force [27] and can be attractive as well as repulsive.

Moreover, plasmas are excellent electrical conductors, similar to wires carrying current. These currents produce their own magnetic fields which generate currents with velocities that can range from 5 to 50 km/sec [27]. Although plasmas have mass, plasmas obey the laws of electromagnetism and commonly accelerate to hyper velocities and engage in gravity-defying behaviors. Not surprisingly, plasmas that descend into the lower atmosphere can easily outmaneuver military aircraft and fly off at incredible velocities.

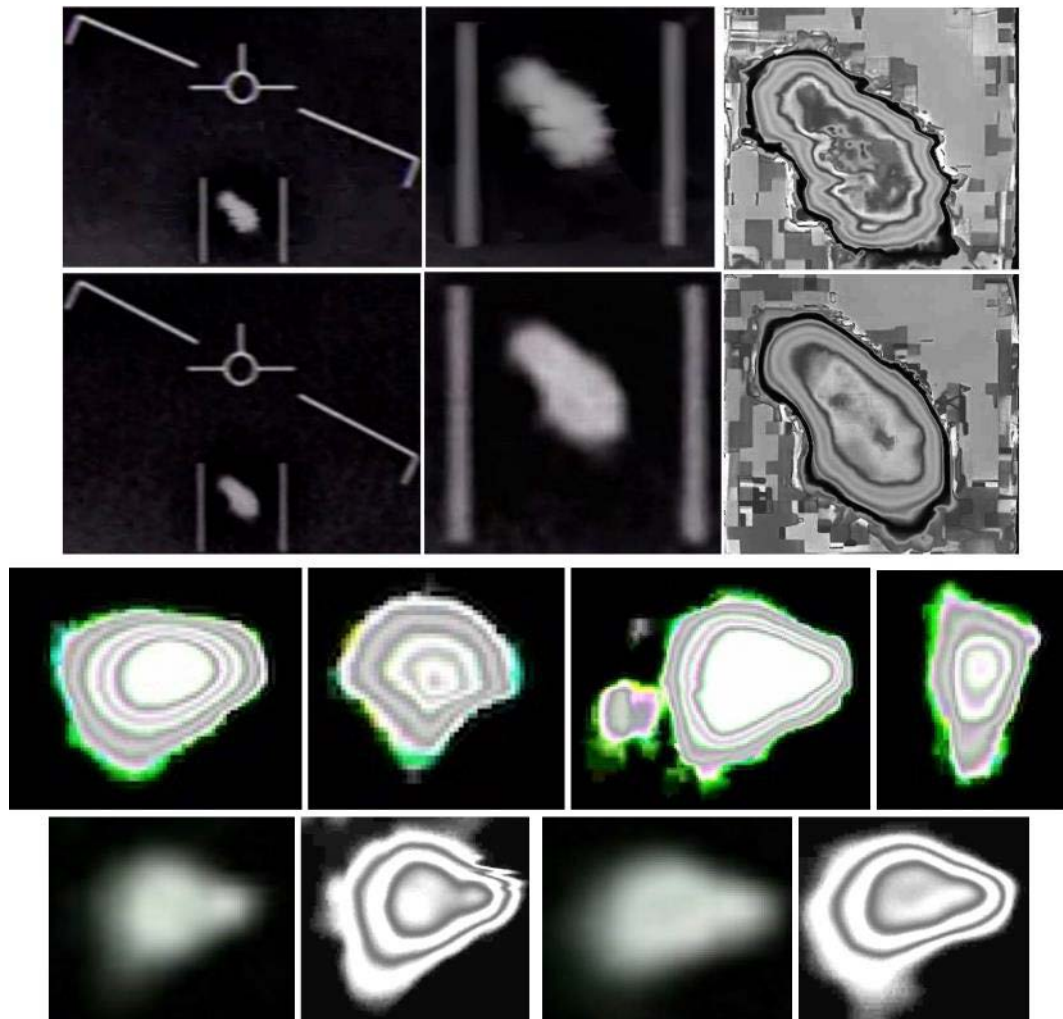


Figure 20. (Top Left) From US Navy Film of UAP. (Top Right). Processed by Fotor Image Software designed to detect pixel-differences in gray scales. Note layered outer-layers which may be indicative of plasmoidic outer-layers or reflective of electromagnetic illumination. (Bottom two rows). Plasma filmed by ST 80. Processed by Fotor Image Software.

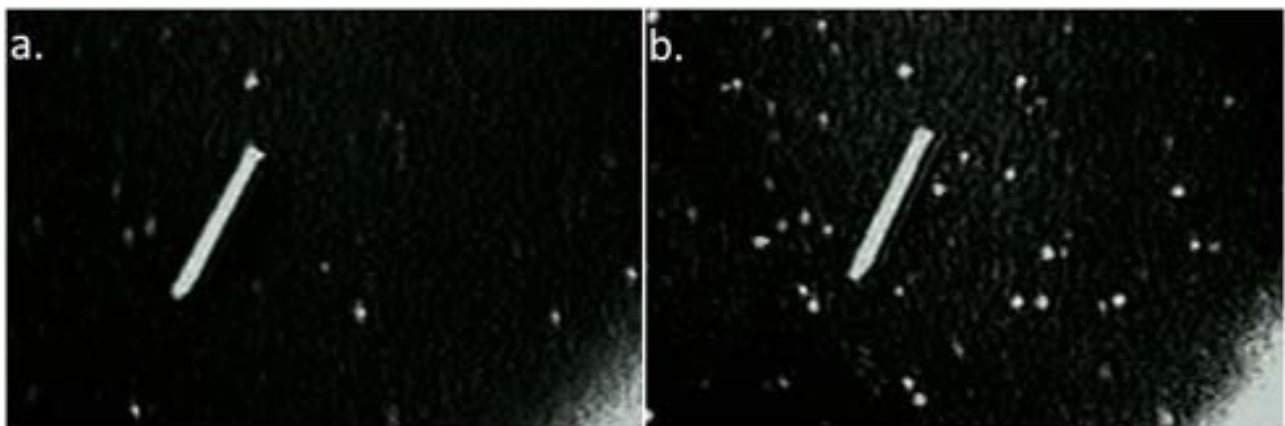


Figure 21. Plasmoids observed in association with a satellite tether (TSS-IR) at the beginning and end of the 18.2s period sampled and subject to analysis: (a) T1, (b) T91 (NASA: STS115). Initially, less than a dozen plasmas/plasmoids appeared, whereas within 18 seconds nearly 100 gathered or swarmed toward the tether which is 12 miles in length and was generating electromagnetic impulses into space.

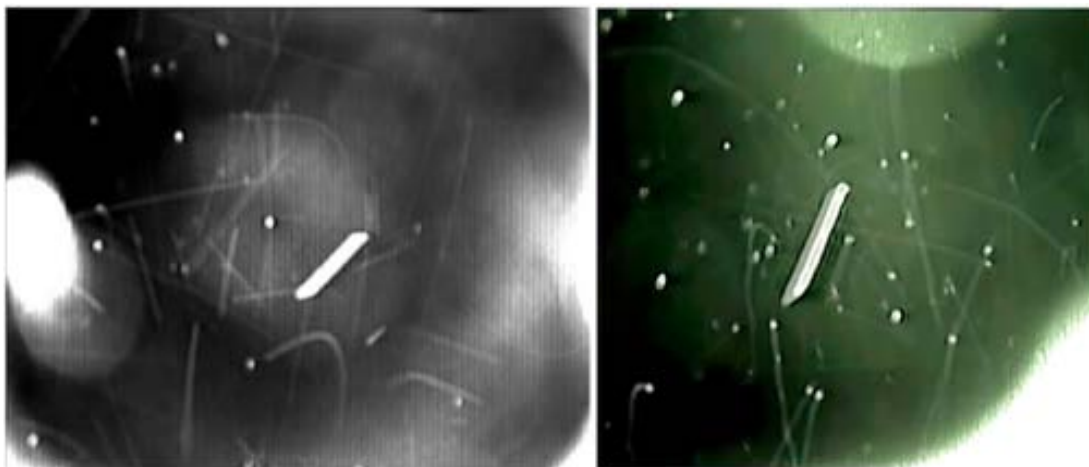


Figure 22. Flight path trajectory, velocity, and tracking plots based on analysis of 53 second (left) and 20 seconds (right) of stable sequences of film footage from the STS-75 determined by “RegiStax” astronomical image enhancement software. Many object display 45, 90, and 180 shifts in trajectory, alter their speed, stop, hover, accelerate, make sudden or slow turns and following one another. The length of the flight path as is directly proportional to that object’s speed. The faster the structure moves the longer the line marking its trajectory. Individual plasmas travel at significantly different velocities, directions, and trajectories some making turns and shifts ranging from 45 degrees to 180 degrees only to slow down and hover, as indicated by the length and curve of each plotted flight path trajectory which is also a measure of velocity.

6. Communication and Luminescence: Plasmas and the Language of Light

Plasmas in the thermosphere are distinct from those created in a laboratory as they are kilometers in size and endure for long, albeit unknown lengths of time. These double, often multi-layered layered dusty plasmoids of the thermosphere have likely incorporated gases, dust, grains, and fragments of meteorite, as well as biological matter cast into upper atmosphere by powerful winds and storms and all of which may be charged to varying degrees, thereby forming interconnected circuits that carry a charge, as well as producing electric currents that flow into the double layers.

As proposed by Alfven [9]-[12] kinetic energy (of the convection) is converted into electromagnetic energy that flows throughout the circuit and generates electrostatic energy in the double layers which emit particle beams of energy and “high energy electrons” which radiates light [26]-[31]. Therefore, plasmas/plasmoids in the thermosphere are self-illuminating because dust, particles, and electrons within or beneath their double cellular layers are highly charged. When these particles and dust become highly excited they collide and the energy released includes photons thereby illuminating the interior and surroundings of the plasma.

For example, electric current from the sun flows into the upper atmosphere and excites plasma to such a degree that it will glow. The magnetospheres of planets have depressions, holes above their magnetic poles (Figure 55 & Figure 56), allowing electric current from the sun to gain entry to the upper atmosphere and triggering brightly colored plasmas, e.g. auroras. Auroras (also known as the northern lights and southern lights) have a variety of colors including blue, red,

yellow, green, and orange which flow and shift gently and change shape as they flow. Auroras are plasmas. Colors depend on what internal gases are being ionized, which is why auroras have a variety of hues.

Plasmas created in the laboratory with high intensity electric currents also change shape and will glow (as do those in the thermosphere), the brightness depending on the intensity of the strength of the current.

Plasmas in the thermosphere not only glow with light, but many will oscillate with light in repetitive heart-beat rhythms of brightening then dimming. Plasma circuits naturally oscillate. However, different plasmas in the thermosphere often display different patterns and rhythms, whereas not all plasmas will oscillate. Moreover, some, but not all plasmas/plasmoids oscillate with light as they and other plasmoids approach thunderstorms or each other [1]-[5].

Plasmoids appear to communicate via oscillations in size and illumination, with some oscillating between bright and dim and from a larger to a smaller size relatively rapidly as they approach and others relatively slowly after they pass by other plasmas (Figures 24, Figures 26). Yet others that were illuminated seemingly disappear, presumably because they “turned off” their light (Figure 23) or flew off into deep space, whereas others may suddenly or rapidly materialize (Figure 8, Figure 9, Figure 13), possibly because they were in a dark mode and turned on their lights, or because they erupted from a hole in space-time.

Those that are “cone-shaped” are the most likely to alter their patterns of size and illumination; behaviors that resemble rhythmic pumping (Figure 8, Figure 24, Figure 26, Figure 27). Not uncommonly, several cone-shape object relatively near one another, differ dramatically such that one will be pulsate rapidly as it “swims” through space and near other plasmas whereas another cone-shaped plasma oscillates slowly, and a third-which may be hovering in place, not at all (Figure 27). As there appears to be no electromagnetic explanations that can explain these differential behaviors, it is reasonable to hypothesis these actions are purposeful, and may serve some communicative function.

Not all plasmas will emit light. The ionosphere is a plasma that does not emit light except during auroras. Much of the universe consists of plasma, which is in a dark mode. Furthermore, shadowy dark shape-shifting forms have been observed among plasmoids congregating near the electrified tether filmed by STS 75. Some of these latter plasmoids have also been noted to glow as they approach and contact other plasmas (Figure 18) and this may be due to increases in electric current and voltage across their layers. Or, it may serve a communicative function and is purposeful.

Therefore, plasmas operate in a dark mode, normal glow mode, arc mode and oscillate with light. The brightness of the glow likely depends on current intensity and plasma density. The stronger the current, the brighter the plasma. If current density increases and a higher voltage passes across a plasma it will light up. However, if the voltage drops the plasma will also light up. This is due, in large part to the movement of electrons. Electrons, being less massive than ions, also move

about freely, back and forth around the more slowly moving ions, creating harmonic oscillations and produce light when they move between energy levels within an atom [27]. When an electron “jumps down” to a lower energy level, it emits a photon of light with a specific wavelength and color depending on the energy difference between the levels. Different energy level transitions produce different wavelengths of light, which can be perceived as oscillations as the light dims and brightens. Hence, plasmas respond to continued increases in current with a rise then a drop then a rise in voltage and the plasma will oscillate in size and with light. As current continues to increase, the plasma will jump into an arc mode and shine with high intensity bright white light.

It could be argued, therefore, that Plasmas, are responding to the charges and electrical circuits in their immediate environment. That environment includes plasmas with different densities and electric charges. However, this explanation cannot account for why plasmas are also expanding and shrinking in size as they move through space; and why those adjacent show different patterns of oscillation; and why those approaching vs passing by other plasmas oscillate at different speeds [27]-[36]. These latter observations support the hypothesis that some plasmoids may be communicating via a “language of light” *i.e.*, oscillating electromagnetic waves and that the shape-shifting pumping patterns of shrinking and expanding are a means of purposeful locomotion.

Given that plasmas also display a variety of shapes and behaviors, and the fact that not all oscillate in size, shape, and illumination, also further documents that a variety of plasmoids dwell in the lower and upper atmosphere [26]-[41] and that diverse species of “life” swim the seas of space surrounding our planet.

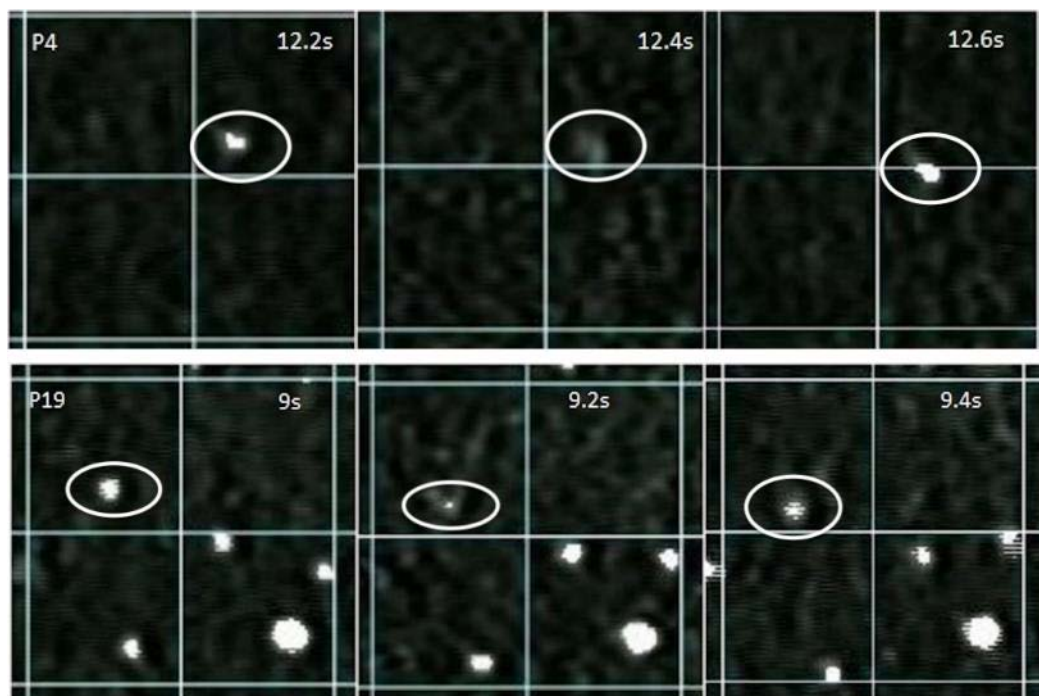


Figure 23. Waxing and waning illumination in heart-beat-rhythms every 2 seconds.

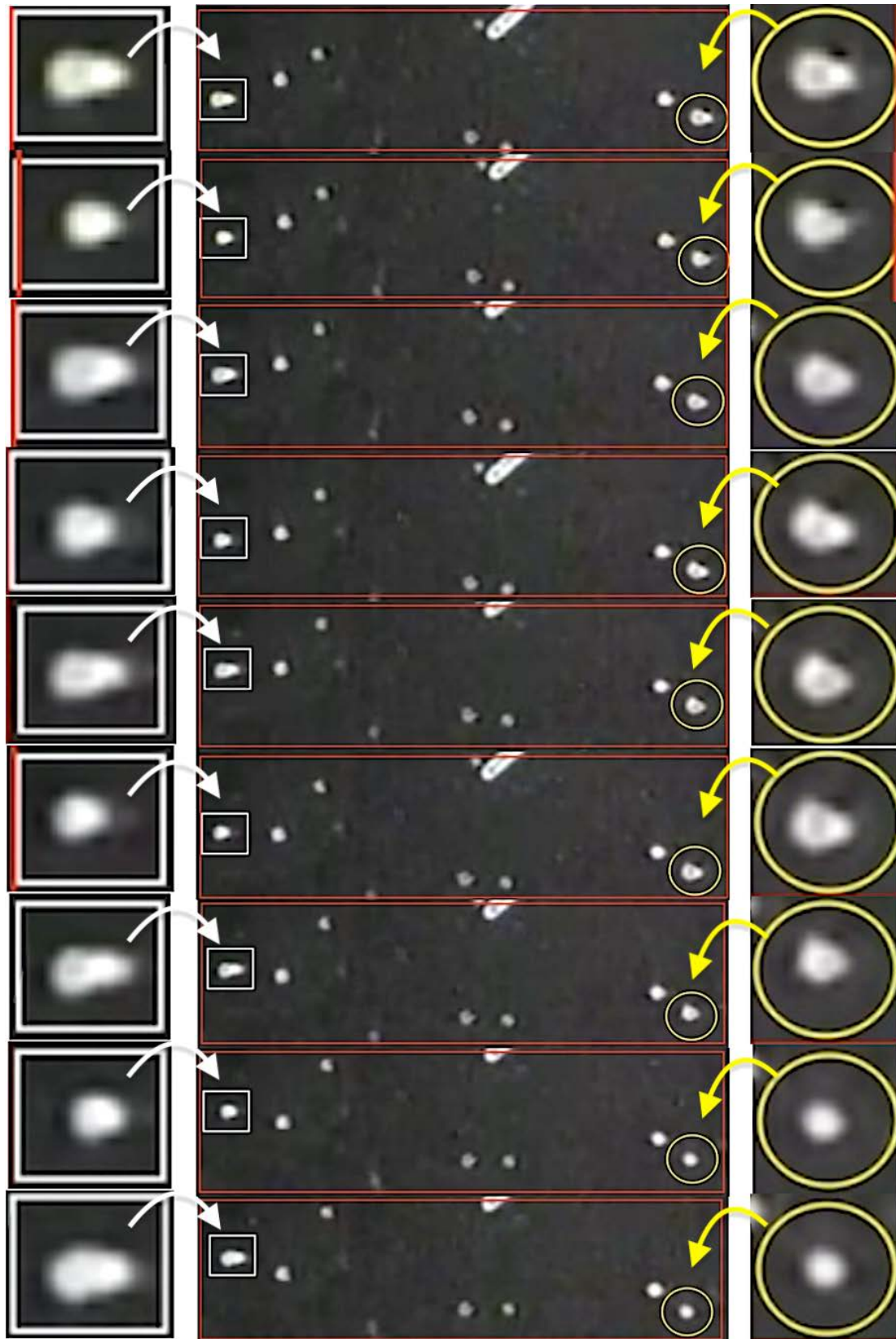


Figure 24. Plasmoid to the left oscillates in size and brightness rapidly as it approaches and then lingers near another plasma (that is not oscillating) whereas, plasmoid to the right oscillates relatively slowly as it passes by another plasma (that is not oscillating).

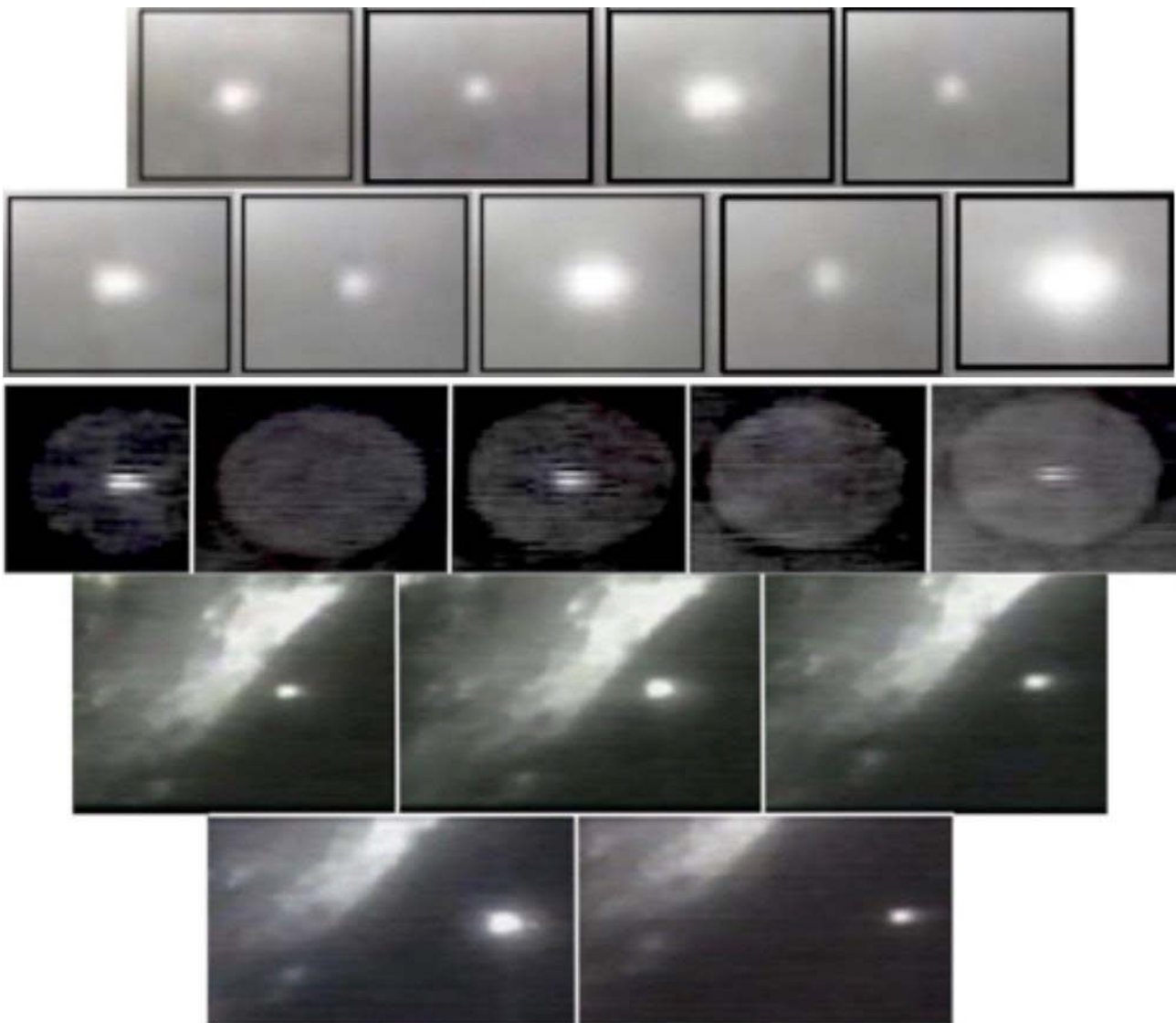


Figure 25. Different patterns of pulsating from dim to bright illumination.

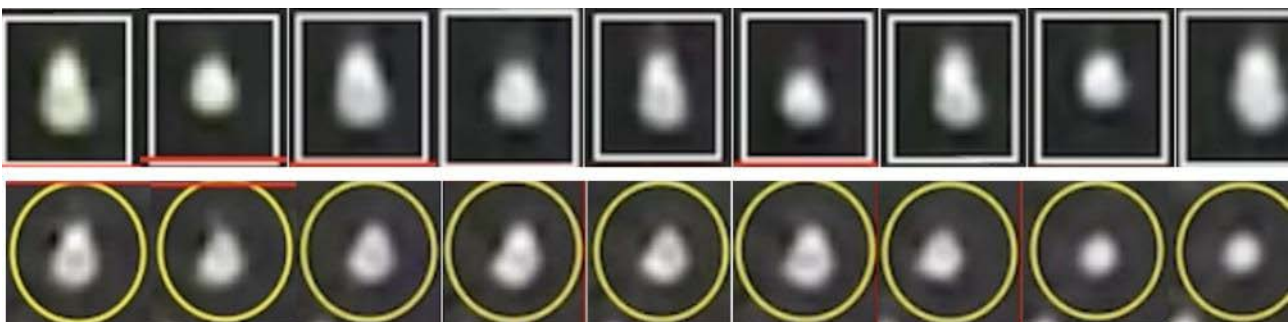


Figure 26. These two cone-shaped plasmoids were filmed simultaneously at an estimated distance of 12 KM (7.5 miles) from each other yet differed dramatically at the rate of oscillation.



Figure 27. Three cone-shaped plasmoids displaying different patterns of illumination oscillation. The plasmoid at the top (white square) oscillates relatively rapidly compared to the plasma at the bottom, whereas the plasma (circled in aquamarine) does not oscillate. One major differences: the plasma at the top is approaching, the one at the bottom has passed by, and the one in the circle is stationary.

7. Bioluminescence. Comparisons to Green and Blue-Green Algae

Terrestrial and ocean-dwelling vertebrates and invertebrates also self-illuminate (bioluminescence) and may pulsate from bright to dim. They do so to attract mates, to lure prey or to discourage predators [32], *i.e.* it serves to communicate information. The key light producing enzymes include crystalline luciferin (which is fluorescent) which interacts with oxygen; and/or with cofactors such as magnesium or calcium ions and often in the presence of adenosine triphosphate [32]. Although luciferin has not been detected in space, magnesium, oxygen, calcium have been repeatedly detected and is abundant [42]-[56].

Fungi and algae may also glow with light, as will ocean waters in the wake of a fast-moving ships due to agitation of surface-dwelling dinoflagellates, plankton and bioluminescent algae. Dinoflagellates (eukaryotic algae), zoo plankton and single-celled animal plankton glow because of a chemical reaction that occurs inside their cells when they are disturbed. When the organism's outer membrane is stressed, they sparkle with light. These reactions have a communicative purpose that serves to attract food, or conversely ward off predators by startling them with a bright flash.

As noted, Sagan [17] proposed that giant algae-like organisms swim the atmospheric seas of Jupiter; whereas direct comparisons have been attributed and made between the behavior and multi-cellularity of algae colonies and the colonial appearance of some plasmoids in the thermosphere [3]-[5]. In fact, like algae, some plasmas in the thermosphere form interlinking "bridges" with other plasmas, and like algae, some plasmoids consist of colonies of plasmas (Figure 28). And both "species" emit light.

Algae, like plasmoids, respond to, orient toward, and "feed on" electromagnetic energy; *i.e.*, algae engage in photosynthesis, a process via which light (electromagnetic energy) is transformed into chemical energy. Algae also engage in "social behavior" and congregate together and may form algae-bridges with other algae, whereas plasmoid form plasma-bridges that link numerous plasmoids together. As documented, plasma in the thermosphere also engage in energy cannibalism, and the same is true of algae which will cannibalized other organisms including algae from which they extract energy.

Experiments have documented that algae and other organisms survive direct exposure to the thermosphere for months and years at a time [57] [58]. The thermosphere is the natural habitat of plasmas.

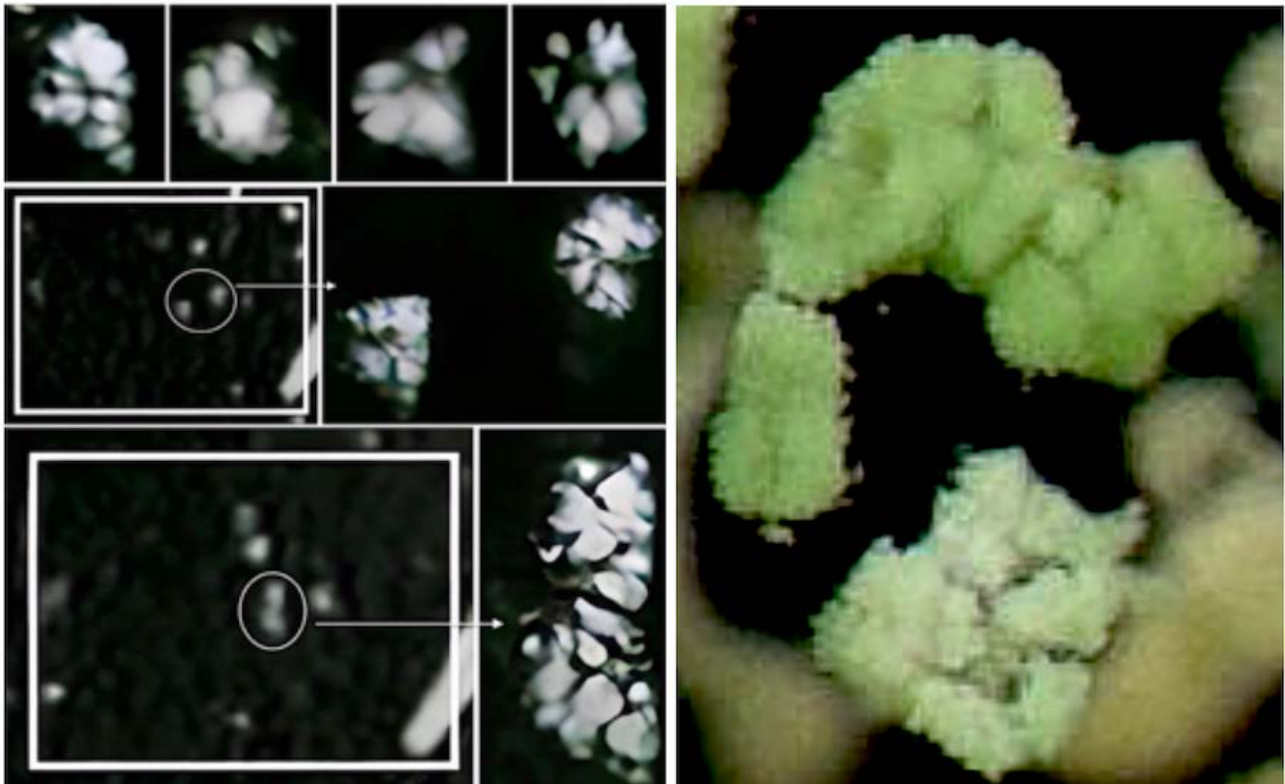


Figure 28. Left: Multi-plasmoidic conglomerates filmed in the thermosphere (processed via Fotor Optics Filters). Right: Multi-algae colonial conglomerates.



Figure 29. Plasma form multi-plasma “bridges” that link numerous plasmoids together. From STS 80. Processed via Fotor Optics Filters to identify and colorize differences in pixel gray scales.

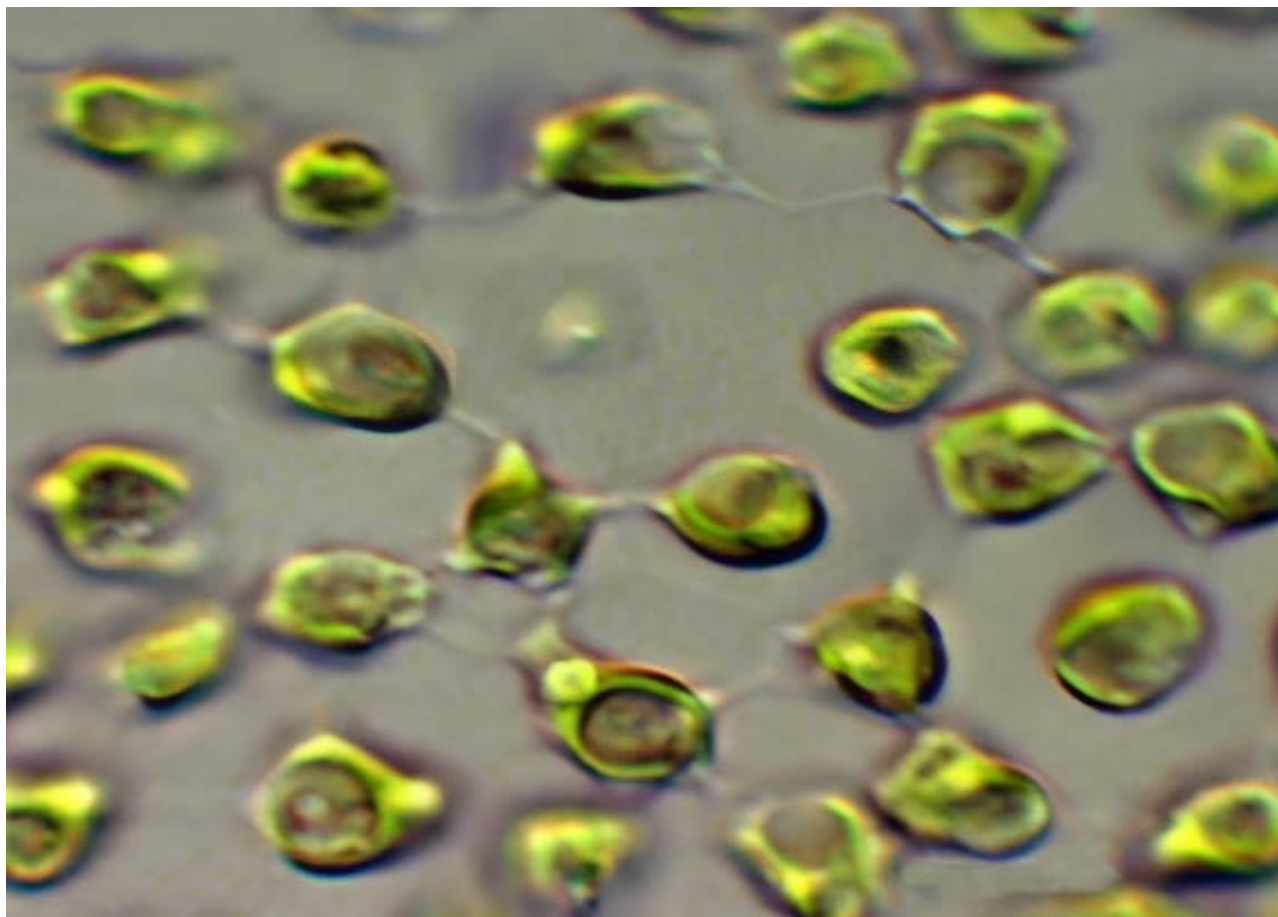


Figure 30. Algae forming multi-algae bridges that link numerous algae together.

8. Plasmoids: Multi-Layer Cellular Membranes

Langmuir [6]-[8] was the first to use the word “plasma” to describe those created in a laboratory. Langmuir observed that the fluid-like behavior through which high velocity electrons and ions and plasmas were moving was similar to the way blood plasma carried white and red corpuscles. He also noted that when a charged object is introduced the plasma will form cellular structures and double layers. Hence, the term “Langmuir sheaths” refers to the double layers and cell walls typically formed by plasmas.

That plasmas in the thermosphere have double (and often multiple) layers, voids, and what resembles a nucleus, has also been documented [1] [2] as also reported here (Figure 1, Figure 2, Figure 20, Figure 29, Figure 31). It is unknown if these layers and cell walls consist solely of plasma or a plasmoidic concentration of substances commonly found in space and in the upper atmosphere such as oxygen, carbon, and hydrogen and the remnants of carbonaceous chondrites and organic-biological matter.

Eukaryotic cellular layers and membranes are comprised of lipids. Lipids also play a major role in the formation of vesicles and cellular membranes that form separate compartments within a cell’s interior. Cell membranes are made from

lipid-bilayer sheets, which are large assemblies of phospholipids that form two layers.

It is noteworthy that meteorites contain simple lipids, such as fatty acids and ether-linked acyclic hydrocarbons (as well as amino acids and nucleotides), which, in combination make up more than 60% of soluble organics in meteorites [42]-[52]; all of which would be dispersed when these meteorites shatter upon striking the upper atmosphere [2] and which may be incorporated into thermosphere plasmas.

As is well known, lipids can self-assemble and form bilayers, vesicles and hollow cellular-like membranes held together by non-covalent interactions.

If dusty plasmas incorporate lipids dispersed by shattered meteorites, might they reassemble and form layers, compartments and vesicles? It is reasonable to ask this question; especially given evidence that in addition to layers some thermosphere plasmoids appear to have a nucleus and compartmentalized inner structures and multiple layers.

Although the composition of these plasmodic layers is unknown, it is not unreasonable to hypothesize that dusty plasmas may have incorporated lipids; and these lipids may have self-assembled and contributed to the formation of plasmodic walls and layers. And if these inner and outer layers are permeable this would allow for ion and nutrient transport, storage, and the absorption and generation of energy. Further, in the presence of multiple sources of energy, radiation, and hydrogen gasses, these multi layered membranes would likely evolve capacitance, with hydrogen, oxygen or other gasses acting as an additional energy source.

However, lipids in modern (terrestrial) cell membranes have carbon chains that are typically 12 - 20 carbons long [52]. Meteorites contain fatty acids which are 2-12 carbons in length; which may, or may not be sufficient to maintain the double layers of thermosphere plasmoids. On the other hand, it has been hypothesized that the original molecules in ancient membranes were smaller and less complex [52] [53] whereas vesicles can be composed of a single fatty acid type as short as 8 carbons in length [54]. Meteorites contain fatty acids 2 - 12 carbons in length; therefore vesicles could indeed form directly out of meteorite-delivered fatty acids [42] [55] [56]; and, to speculate, may have contributed to the layers and internal compartments that characterize the plasmas of the thermosphere.

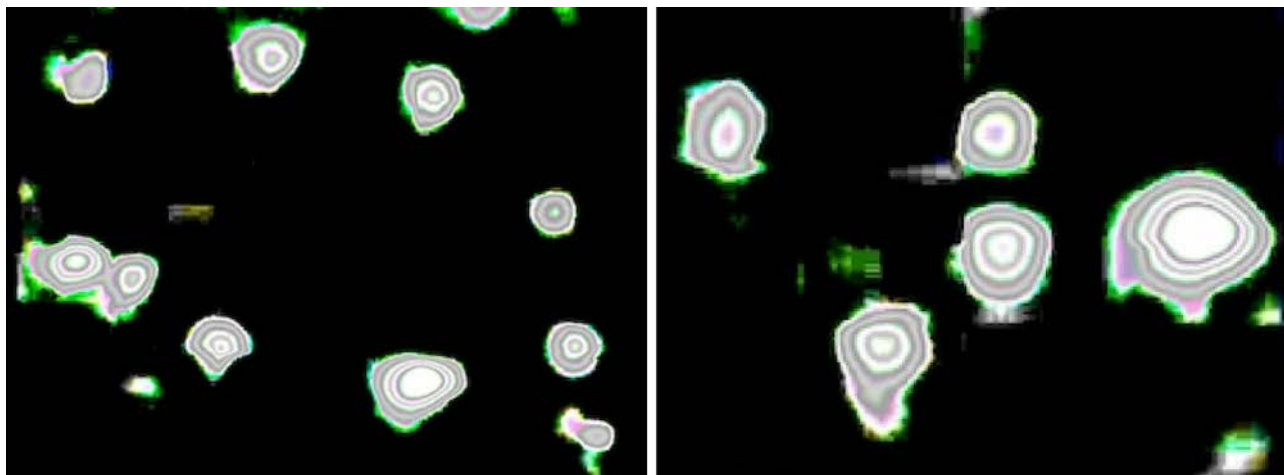


Figure 31. Plasmoids filmed by STS 75. Processed via Fotor filters which identify differences in pixel gray scales.

9. RNA, DNA, Fourth Domain of Life?

At present, three domains of life are recognized: Archae and Bacteria (collectively referred to as prokaryotes), and multi-cellular eukaryotes. Although viruses have an RNA or DNA genome, they are not considered to be living entities. That the three branches of life—and some viruses—all possess a DNA-based genome, and given the universality of the genetic code, supports the hypothesis that DNA is a “cosmic imperative” and a requirement for life “as we know it”; and that to achieve life requires the acquisition of a DNA-genome. Can plasmas/plasmoids be considered living entities and a fourth domain of life if they do not possess an RNA-DNA based genome?

Lipid bilayers are permeable to amino acids and would enable dusty plasmas to incorporate the shattered remnants of carbonaceous chondrites and all the nucleotides, acids, proteins necessary for life and the fashioning of RNA and DNA. However, plasma, in-itself is permeable, which would allow all these chemicals and molecules to become incorporated.

As will be detailed, all the ingredients and conditions necessary for building complex molecular organic structures, amino acids and proteins are present in space and in nebular clouds including phosphorus, calcium, water, carbon, and oxygen; which when mixed together and irradiated might easily produce self-replicating carbon-crystal-helices. In fact, all the necessary elements, chemical, amino acids and nucleotides necessary for the establishment of a RNA-DNA, and thus life, are abundant in the vast environment of space and the upper atmosphere; and which would likely be incorporated within dusty plasmas via their semi-permeable plasma membranes.

Hydrogen, oxygen, carbon, calcium, sulfur, nitrogen and phosphorus incorporated within a dusty plasmas would be continually irradiated by ions thereby generating small organic molecules which would then evolve into larger complex organic molecules thereby resulting in the formation of amino acids and other compounds. Moreover, the presence of hydrocarbons (catalyzed by stellar radiation),

once incorporated, could be employed for polymerization and the additional creation and assembly of the necessary elements and macromolecules essential for life [57]. Further, in the presence of multiple sources and types of energy, radiation, and hydrogen gasses, these double layered membranes would likely evolve capacitance, with hydrogen, oxygen or other gasses acting as an additional energy source.

Given that energy and all the necessary life-sustaining molecules, acids and nucleotides may be commonly incorporated within a dusty plasma, it is not unreasonable to assume that this mix would eventually lead to the creation of at least a single strand of DNA. Further, these combinations would be continually irradiated, engulfed with electromagnetic energy, thereby providing these coalescing organic molecules and strands of DNA with additional sources of energy. To speculate: eventually, this energized DNA-membranous-protein-plasmoid complex would have begun to function as a proto-organism with all its needs provided by the chemically and electromagnetically enriched surrounding environment. Even if these initial strands of DNA consisted of only 4 base pairs, these complex plasmodic-cellular structures would have begun evolving. With every replication the plasmoid genome would have expanded and become more variable and more complex.

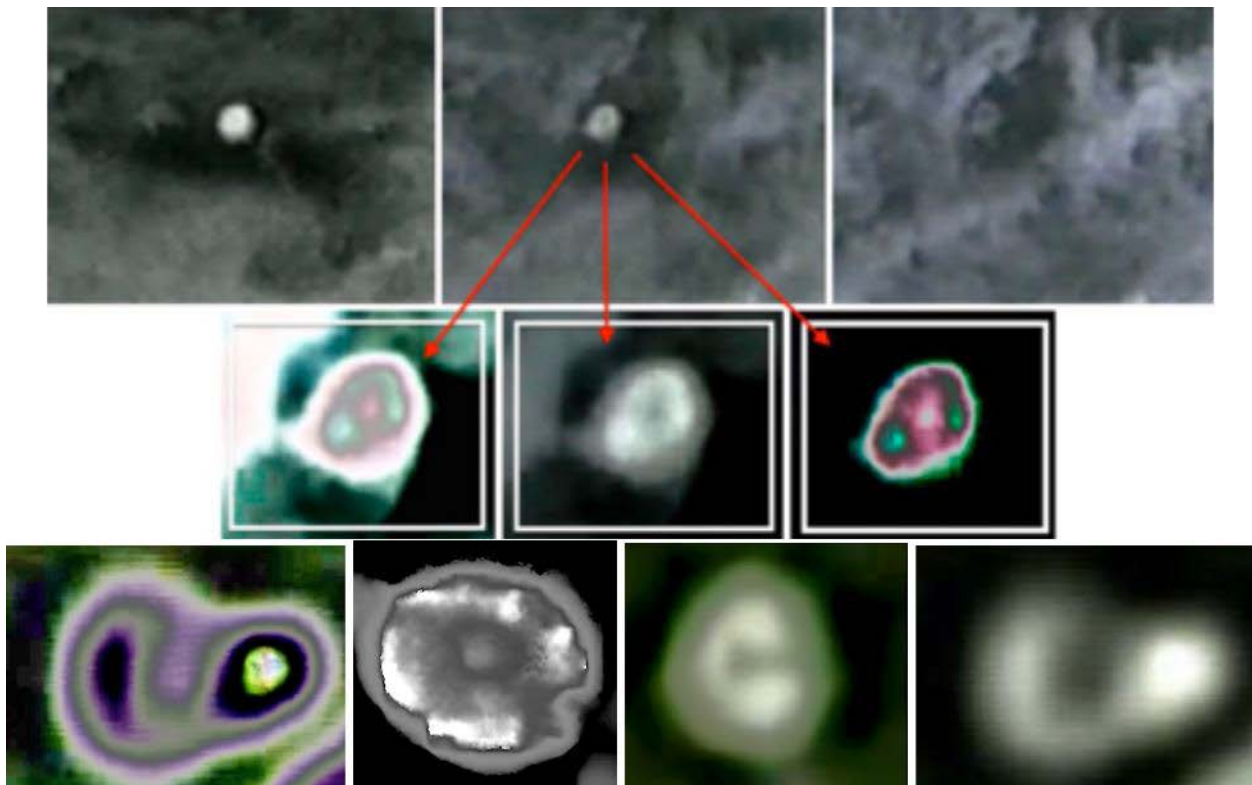


Figure 32. Plasmoids of the thermosphere processed via Fotor image software to detect and colorize internal structures based on identification of differences in pixel gray scales. Note helical, spiral internal structures, nucleus and spiral ganglia which are common attributes of plasmoids. We can only speculate as to the nature of these internal structures, due to the fact that NASA added four layers of noise and would turn off the camera within 20 seconds after these specimens would come into view [3].

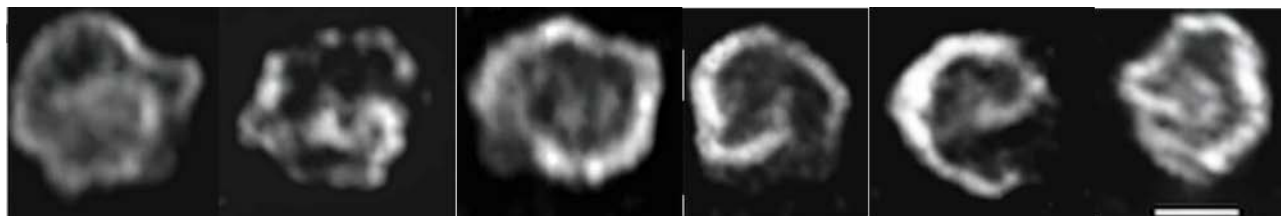


Figure 33. Electron microscopic images of chromatin and its helical contours and structure. Chromatin is a complex of DNA, RNA, and proteins that condenses DNA which is wrapped around nuclear proteins and forms chromosomes. Reproduced and modified from Bartolome, S. *et al.* (1994) Internal Structure of 30 nm chromatin fiber. *Journal of cell Science* 107, 2983-2992 [58].

10. Electricity and the Origins of Life

For over 300 years it has been believed that electricity and lightning are essential for the creation of life [59]-[65]. Consider, for example, the contraction of frog muscles when directly stimulated by electricity from Leyden jars or when a long metallic wire connected to the nerves are excited by lightning. These life-like reactions were first documented in the 18th century by Galvani and Volta who demonstrated that lightning, atmospheric electricity, electrical fields and nerve conduction share similar properties [60] [62]. This relationship was again dramatically demonstrated in 1803 when Giovanni Aldini employed electro-stimulation to activate the deceased body of an executed criminal [59]-[62]: “On the first application of the process to the face, the jaws of the deceased criminal began to quiver, and the adjoining muscles were horribly contorted, and one eye was actually opened. In the subsequent part of the process the right hand was raised and clenched, and the legs and thighs were set in motion.” Mary Shelly knew of these and other experiments and it was electricity which brought her Frankenstein monster to life.

By the 20th century many scientists began to believe that intense energy from lightning strikes in Earth’s early atmosphere provided the necessary conditions to create the basic building blocks of life, including amino acids, by converting readily available elements like nitrogen and carbon into usable forms; the electricity from lightning acting as a catalyst for the chemical reactions that, theoretically, led to the emergence of RNA, then DNA and the first forms of life. Stanley Miller and Harold Urey [63]-[65] put this theory to the test by exposing a mixture of water, methane, ammonia, and hydrogen to electric sparks between a pair of electrodes to mimic lightning in a gas-filled flask. These experiments were based on the theory that lightning could have led to the formation of prebiotic molecules. They successfully produced a variety of organic compounds and amino acids, including glycine, α -alanine and β -alanine, aspartic acid and α -aminobutyric acids [65]. However, like all previous and subsequent experiments, life has never been created from non-life, at least, not on Earth.

11. Meteorites, Nucleotides, RNA, DNA and Amino, Nucleic Acids in Space

Meteors are subject to electromagnetic, electric, and ionizing forces, and several

meteorites that fell to Earth have been found to contain a variety of amino acids [43]-[51], including and especially the Murchison meteorite. Amino acids provide the building blocks for proteins; and the sequence of amino acids in a protein is determined by the genetic code contained in the nucleotide sequence of DNA and RNA. Ionization is a critical to the process-and ionization is ongoing within the thermosphere.

The ionization and chemistry of amino acid side chains is critical to protein structure because these side chains can bond with one another to hold a length of protein in a certain shape or conformation. That is, charged amino acids form ionic bonds, and polar amino acids are capable of forming hydrogen bonds and are the building blocks of proteins, which are ultimately produced based on the genetic information coded in DNA and transcribed into RNA [57]. Essentially, the sequence of nucleotides in DNA dictates the order of amino acids in a protein, making amino acids the functional output of the genetic code stored in the nucleic acids of DNA and RNA.

The Murchison meteorite that fell near Murchison, Victoria, Australia in 1969 has been extensively examined, and Fourier-transform ion cyclotron resonance mass spectrometry has detected over 10,000 unique compounds [42]-[47]. Twelve amino acids, including N-methylglycine, β -alanine, 2-methylalanine, and α -amino-n-butyric acid as well as alkyl amides—all of which can be converted to amino acids by hydrolysis-have also been identified [47]-[48]. The Nakhla, Orgueil, Asuka and Ivuna meteorites have also been found to be rich in amino acids, including glutamic acid, glycine, aspartic acid, serine, alanine, β -alanine, and γ -amino-n-butyric acid [43]-[45]. Moreover, the Ryugu asteroid was found to contain a total of thirteen amino acids and an additional five amino acids that were tentatively identified but not quantitated, as well as abundances of four aliphatic amines [50].

In fact, all five nucleobases that make up DNA and RNA—adenine, guanine, cytosine, thymine, and uracil—have now been found in meteorites [50]. Further, glycine and tryptophan which are essential for protein formation have been identified in interstellar space. Thus, amino acids and nucleotides have been found in meteorites that have crashed to Earth and are common in space.

In addition, the combination of hydrogen, carbon, oxygen, nitrogen, cyanide and several other elements, could create adenine, which is a DNA base, whereas oxygen and phosphorus could ladder DNA base pairs together. Hence, the building blocks for DNA could have been generated or combined within dusty plasmas; and DNA would become part of this molecular-protein-amino acid complex, along with lipid-like structures due to the interaction of phosphates with sugars. If incorporated into a dusty plasma, might these essential ingredients become transformed into RNA and DNA?

According to Powner and colleagues [66] they were able to mix and irradiate all the precursor molecules identified in interstellar dust clouds and meteorites and create ribonucleotides: the basic building blocks of RNA. Ribonucleotides are also important in DNA replication and numerous biological processes. Subse-

quently, Papastavrou and colleagues [67] reported that they created an RNA molecule using these and other ingredients; that, although unable to self-replicate, accurately copied other RNA molecules and resulted in a functioning enzyme.

Synthetic DNA has also been created in a lab. Khorana [68] synthesized a gene which coded for the enzyme involved in the transfer RNA or tRNA synthesis. Specifically, double-stranded DNA was cut into short single-stranded segments then synthesized. The segments formed bi-helical complexes and spontaneously joined end-to-end creating covalently linked duplexes which then curled together forming 207 base-pair-long DNA and voila: a synthetic gene.

What all these experiments demonstrate is that RNA and DNA can be synthesized if provided with all the ingredients commonly found in meteorites and space. However, all these experiments failed to produce life or RNA or DNA that could self-replicate; presumably because all the necessary conditions and incubating environments for creating a functional genome and “life” could not be recreated in a laboratory. But what if the “laboratory” was a plasma in the thermosphere?

The implications are: since RNA and synthetic DNA can be created in a laboratory then certainly RNA and DNA might have been created within a dusty plasma over billions of years of time. In fact, this scenario becomes highly probable considering the likelihood that plasmas have had at least 13 billions of years to synthesize RNA and DNA. Furthermore, in Earth’s upper atmosphere, and for several billions years, dusty plasmas may have engulfed not only all the essential ingredients but a variety of terrestrial organisms and their RNA and DNA. And, hypothetically, via the acquisition of electric charges and horizontal gene transfer all this genetic information may now be part of the dusty plasma genome.

12. Dusty Plasmas and Hypothetical Origins of RNA-DNA

Some authors have argued that plasmas may represent a form of “pre-life” or inorganic non-biological life [1]-[5] [16] [28] [33]-[36] and may have provided an incubating environment for the fashioning of DNA-based life [1].

Plasmas in the thermosphere are also referred to as “dusty plasma” [69] because they have incorporated dust, grains, and the remnants of carbonaceous chondrites that have shattered upon striking the upper atmosphere [1]. The implications are that some upper atmospheric plasmoids likely incorporated the nineteen terrestrial and seventy-three extraterrestrial amino acids that have been detected in carbonaceous chondrites and all five of the nucleobases that make up DNA and RNA. In fact, all the common elements essential to life flow through space and may become incorporated within and beneath the multiple layers of a plasma, including carbon, oxygen, phosphorus, sulfur, nitrogen, cyanide, calcium, and hydrogen and which, when irradiated will form organic molecules [57] [70]-[72].

Once incorporated within a plasma, these molecules, nucleotides and amino acids, would be subject to ion chemistry [1] and could evolve into larger complex organic molecules and compounds including adenine which is an RNA-DNA

base, as well as other nucleotides within the dust-induced plasma void-nucleus, leading to electrically charged lattice- and corkscrew-shaped assemblies of nucleic and amino acids [1] [28] [33]-[36]. Theoretically, these could form enzymes and proteins that begin catalyzing reactions within the plasma cell membrane giving the membrane adhesive stability and conferring movability; and leading to the generation of self-replicating RNA-like polymers and protein enzymes (polynucleotides) that resemble RNA but are chemically simpler and can act as a catalyst [57].

Polarized radiation induces asymmetric photochemistry leading to homochirality and the induction of chiral asymmetry which can produce quantities of L-amino acids. In combination with tryptophan this could lead to the formation of proteins, nucleobases and then RNA within dusty plasmas located in the thermosphere. RNA can store genetic information encoded in the order of its monomers, the ribonucleotides, as well as catalyze its polymerization and self-replicate [70]-[72]. Oxygen and phosphorus could ladder RNA-DNA base pairs together [57].

Plasmas, in fact, form spiral helix-like loops when exposed to high intensity currents which act to compress and pinch the layers together. Plasmoids with twisted corkscrew spiraling shapes are commonly observed in the thermosphere [1]-[5] and are created in the laboratory when plasmas are exposed to high intensity electric currents [28] [33]-[36] [73]. Because dust and fragments from meteorites are likely highly charged they may trigger the formation of double layers within which this molecular-protein-amino acid complex and the building blocks of nucleotides and other vital prebiotic molecules could have been exogenously incorporated; perhaps forming a nucleus. Moreover, once embedded within the plasma, they may twist, spin, and may form helical structures that can evolve into a double helix similar to the double helix of DNA [28] [33]-[36]. Spiral helical internal structures are common among plasmoids in the thermosphere (**Figure 1**, **Figure 32**).

We have hypothesized that plasmas could produce an internal “RNA-world” and achieve a form of “pre-life” and then continue to evolve and form DNA [1]. Computer simulations of the reduced gravity of space have shown that plasmas will bond together, forming electrically charged corkscrew-shaped assemblies that resemble strands of DNA [28] [33]-[36] and chromatin which is a helical, spiral complex of DNA, RNA, and proteins that condenses DNA and forms chromosomes (**Figure 33**). Hypothetically, this combination could have led to the first RNA world (within a dusty plasma), followed by DNA-based life [1] [2].

The fact is: the conditions necessary to generate living plasma are common in space. Hence, perhaps the complex behaviors of plasmoids are life-like, because they are alive.

It is reasonable to ask: might a transition from non-biological plasma-cellular to biological cellular occur following the acquisition and synthesis of organic matter, proteins, amino acids, nucleotides, etc. have taken place within the plasma’s nucleus? Is it possible that dusty plasmas in space have acquired RNA then DNA

and are alive? Might this explain their complex behavior?

13. Have Dusty Plasmas Incorporated Bacteria, Fungus, Algae, Lichens, Plankton and DNA?

The prevailing consensus, based on multiple lines of evidence, is that Earth's electromagnetic field has been in existence for at least 3.5 billion years and was present near the end of the heavy bombardment phase after life had already taken root on this planet [74] [75]. The plasmasphere is within the innermost part of Earth's magnetosphere and above the ionosphere and surrounds and rotates with Earth, and is constantly bathed in streams of plasma from the Sun. NASA space shuttle films have revealed a brightly illuminated ring of plasma, within which plasmoids can be detected, and which appears to attract and/or generating plasmoids (Figure 34). Therefore, it can be assumed that plasmas have swam the upper atmosphere of Earth for over 3.5 billion years.

The surface of modern Earth is marked by 200 massive craters that can be seen from orbiting space craft. How many huge bolides have struck the oceans is unknown but must be many times that. Each time a meteor, comet or asteroid struck Earth or its oceans, mountains of dirt, rock and vast volumes of water, and all the life they contained, would have been ejected into the upper atmosphere and space. The Chicxulub impact, 65 million years ago, is believed to have ejected up to 5.5×10^{12} kg of debris [76]. Hence, undoubtedly, terrestrial seeds, insects and their eggs, plants, corals, sponges, fish, crustaceans and other metazoans would have been propelled and ejected skyward by each bolide impact; and unknown numbers would have survived flash frozen in large bodies of water and buried within huge chunks of rock and mountains of debris or clinging to dust and pieces of rock. Therefore, over the course of billions of years, massive amounts of earth and water must have been splashed into the upper atmosphere and space along with innumerable forms of life [75] [77].

It is well established that fungi, lichens, and algae and over 1800 different types of bacteria flourish within the troposphere, the first layer of Earth's atmosphere [74] [75] [78]. Microbes, algae, fungi, lichens, spores, insects, larva, pollen, seeds, water, dust and nematodes are often transported to the stratosphere and mesosphere due to tropical storms, monsoons, thunderstorms, hurricanes, tornados, volcanic eruptions and seasonal and electrostatic upwellings of columns of air [79]-[82]. Microorganisms, fungi, and spores have been recovered at 40 km, 61 km and 77 km above Earth [83]-[85] and even in the thermosphere [86]—which begins around 85 km and extends 600 km above the planet. Might these organisms have become incorporated within dusty plasmas?

In August of 2014 the Russian Space Agency reported that Russian cosmonauts, Olek Artemyev and Alexander Skvortsov, discovered “plankton” and other organisms, living on the exterior windows of the International Space Station [86] despite the subzero temperatures, lack of oxygen and constant exposure to cosmic

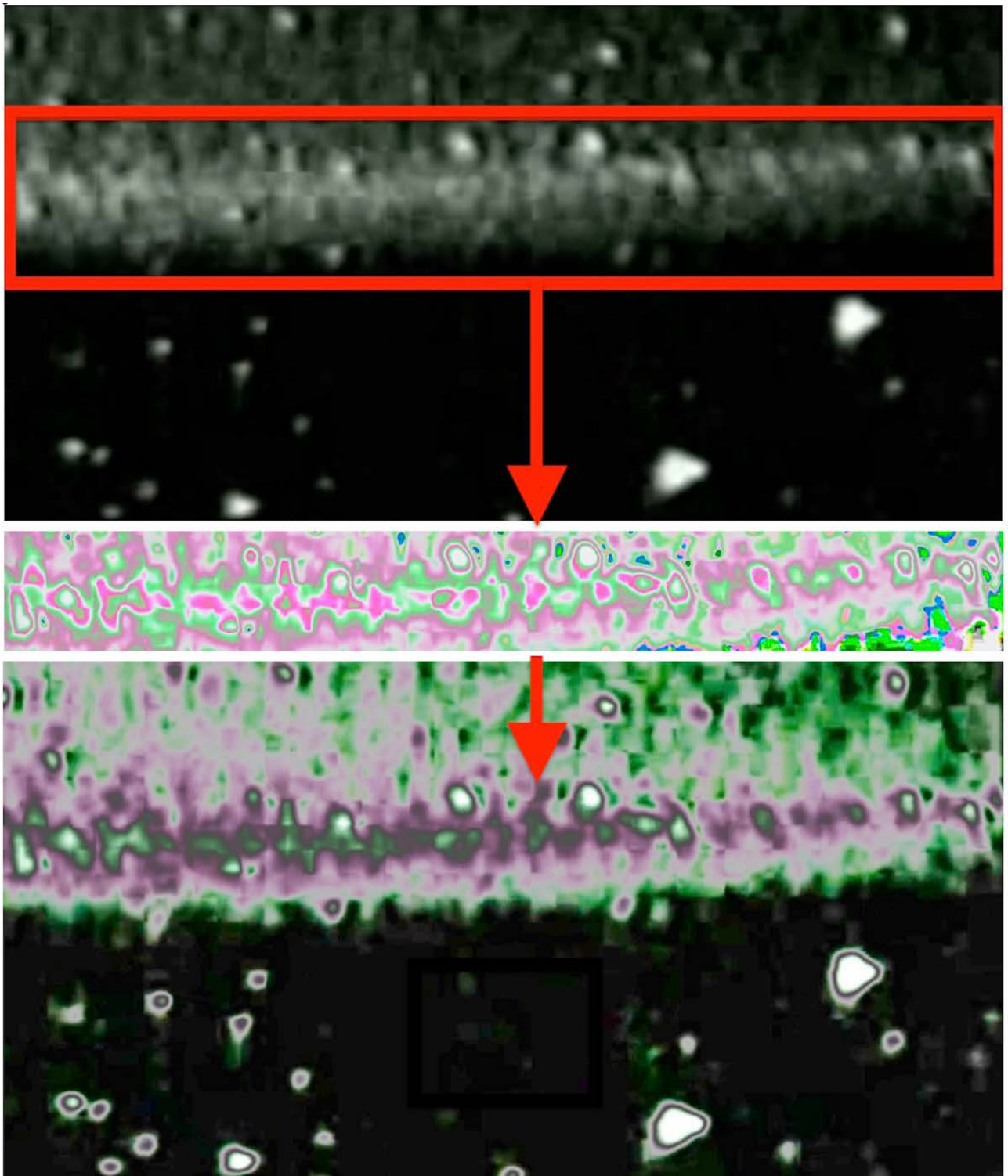


Figure 34. Plasmas gathering toward a thick glowing band of flowing plasmas.

rays. These living organisms included bacteria, algae, protozoa, and fungi, collectively referred to as zoo plankton and single-celled animal plankton and which include those which are bioluminescent. According to the Russian Space Agency, these plankton must have been blown into the thermosphere by powerful current of wind.

It is well established that bacteria, algae, fungi, diatoms, lichens [87]-[91] as well as plants, insects and their eggs and seeds can survive for years in the thermosphere outside of the International Space Station [92]. As documented by Orlov *et al.*'s [92] bacteria, fungi, and plant seeds, mosquito larvae, Mayfish dry eggs and the eggs of crustaceans survived after seven to 13 months exposure, and were able to reproduce. In fact, between 82% to 98% of seeds from radishes, red mustard, rice and barley germinated and “developed normally” and up to 42% of dehydrated fish eggs and eggs of several invertebrate species belonging to three crustacean orders showed normal growth and reproductive capacity despite 13 months of exposure to space outside the ISS. Even after 31 months exposure in the thermosphere “larval tissue and cells were not injured” [92].

Dusty plasmas of the thermosphere have incorporated dust and debris beneath their double cell layers. Hence, it can be predicted that living bacteria, algae, fungi, plankton-and their genomes-lofted into the upper atmosphere-would have also been incorporated.

The implications are two-fold. 1) Dusty plasmas may have assimilated and combined the genomes of all these organisms and in so doing fashioned a unique plasma genome via horizontal gene transfer; or 2) via horizontal gene transfer, the genomes of all these species were combined with a pre-existing plasma genome that had been independently fashioned via the incorporation of all the necessary substances available in space and the upper atmosphere.

14. Horizontal Gene Transfer. Speculation: Plasmoid Assimilation of Living Genomes

Bacteria, archaea, and viruses serve as galactic genetic messengers and are ideally suited for acquiring and making copies of genes, transferring these genes to other species, as well as accepting foreign genes, and then later donating and transferring these genes, including their own genes, to yet other organisms [93]-[96]. Genomic analysis has demonstrated that genes are commonly shared between viruses, bacteria and archaea and between prokaryotes, viruses and eukaryotes via horizontal gene transfer (HGT). For example, a substantial portion of the prokaryotic (bacteria and archaea) genome consists of viral bacteriophages, plasmids, transposable elements, and numerous genes and even large segments of entire chromosomes which have been transferred from species to species via HGT. Among prokaryotes there are very few orthologous gene which were not obtained via HGT. Even introns, ribosomal proteins and RNA polymerase subunits are subject to HGT [93]-[96].

One of the most dramatic examples of HGT is the acquisition of antibiotic re-

sistance which can be conveyed to a new bacterial host [93]. This is made possible via the exchange of mini-chromosomes and free DNA which has been expelled into the cytoplasm of the bacterial cell. These mini-chromosomes then exit and invade another cell belonging to a different host which incorporates these genes into its own genome and immediately develops resistance to antibiotics or various toxins and poisons.

These mini-chromosomes consists of two ropes of nucleotides which may contain hundreds or even thousands of nucleotide sequences and base pairs. These packets of free-DNA can also duplicate themselves and multiply, forming hundreds of identical copies which can be inserted into the main chromosome of the invaded host, including the DNA of alien species. Mini-chromosomes can exit the cell of one species, invade a second species and its genome, attach itself to a row of nucleotides, make or exchange copies, and then jump to yet another position within the helix, and/or exit this cell and transfer these DNA-copies to other hosts [93]-[96].

Hence, mini-chromosomes serve as genetic couriers which are able to travel from chromosome to chromosome, from cell to cell, and from species to species, and from the surface of Earth to the upper atmosphere carrying copies of specific genetic instructions. Once transferred and incorporated into the genome of a host, that host will come to possess the same genes and can acquire traits and genetic information belonging to a wholly different species.

Many scientists believe, based on genomic analysis, that the first Earthly unicellular eukaryotes were fashioned when genes from archaea and bacteria combined thereby inducing eukaryogenesis and giving rise to the eukaryote genome [94]-[96]. It has been theorized that these genes subsequently underwent repeated single gene and whole genome duplications, perhaps in response to regulatory signals or environmental triggers, and unicellular eukaryotes became multicellular and then increasingly complex and intelligent [94].

Gene transfer takes place not only between the living, but the living and the dead [93]. Bacteria decompose, breakdown, incorporate and digest dead and dying plants and animals and their DNA. Hence, it can predicted that horizontal gene exchange commonly occurs among living and dead organisms cast into the upper atmosphere-including acquiring genes harvested from organisms that died after these organisms have been incorporated within a dusty plasma. Therefore, it is not unreasonable to hypothesize that HGT also occurs within dusty plasmas; that genes combine, and over time, a plasmoid genome might be fashioned that includes the DNA from innumerable terrestrial organisms; a plasmoid genome which is surrounded by a nucleus and semi-permeable layers. In this hypothesis proves true, then, plasmoids would have acquired the DNA that codes for innumerable traits and behaviors, including a plasmodic version of the nervous system.

Consider also the phagocytosis of archaea and bacteria and the subsequent donation of their genes to the eukaryotic host. The transfer of these genes and incorporation of these organisms resulted in the creation of sub-compartments con-

sisting of the ingested microbial body that had been stripped of most of its genes [93]-[96]. The establishment of compartments serves a variety of purposes including protection. For example the DNA of multicellular eukaryotes is contained within the nucleus of every cell and the nucleus protects the eukaryotic genome. The nucleus and compartmentalization made it possible for predatory eukaryotes to ingest and phagotocize other creatures while minimizing the risk of random gene mixing and the unregulated incorporation of foreign DNA.

As documented in this and earlier reports [1]-[3] plasmas commonly make contact, collide, merge, and pierce one another. And some dusty plasmas appear to consist of numerous internal sub-compartments and what might be vesicles, organelles, internal filaments, including a separate nuclear compartment containing the cell's DNA. If these enclosures serve to protect and selectively prevent the transfer of substances from one plasmoid to another is unknown.

15. Hypothesis: Plasmoid Genomes and the First vs Fourth Domain of Life

We have provided three distinct science-data-based scenarios in which entities of the thermosphere classified as plasmoid/plasmas may have acquired RNA/DNA and a functional genome: 1) via incorporation and assimilation of all the necessary ingredients available in space and the upper atmosphere, 2) via the incorporation and assimilation of the genomes of organisms cast into the upper atmosphere, and 3) via terrestrial genomes which may have been assimilated into the already established genomes of plasmas.

If the plasmoids of the thermosphere have acquired RNA, DNA, and a genome, and given their complex behavior, then they should be classified as a “fourth domain of life” and possibly the “first domain” as life may have begun within a plasma. However, it must be emphasized: to date there is no evidence that plasmoids contain a genome or even a single strand of DNA.

16. Electromagnetic Explanations for Plasma Life-Like Behavior

Over 95% of space is filled with electricity-magnetic energy, electrical charges, electric plasma, clouds of electrons and ionized particles. In fact, it is believed that 99% of the universe consists of cosmic plasmas [9]-[15] [27] [97]-[99] and which are believed to behave in the same manner as plasmas created in a laboratory. Streams of plasma will clump together and take form and shape and generate double layers in response to electrodynamic forces and engage in lifelike, self-organizing, complex behavior in the presence of electric currents, magnetic fields, and the dust and debris inside them. Therefore, it could be argued that these “behaviors” are merely electromagnetic phenomenon, devoid of purpose.

Much of cosmic plasma is in the dark mode. When illuminated, positive ions are moving in one direction and the negatively charged ions flow in the opposite direction within the double cellular layers. In so doing, they generate electric

fields which radiate outward. Because plasmas differ in shape, size and density, these variations will affect the electrical and magnetic activity generated which in turn will affect other plasmas and their behavior. For example, those with less density are not as brightly illuminated and do not generate as much electromagnetic activity as those with a greater density. These interactions, therefore, although seemingly life-like, could again be explained as merely electromagnetic phenomenon.

Via their double layers plasma can isolate, electrically, one section of itself from another. This is because one layer will have a positive charge and another layer a negative charge. Moreover, internalized dust, debris, fragments of meteorites will also have a charge, which may repel or attract one another or migrate to one area of the plasma depending on whether they have a negative or positive charge. In response to high intensity currents, the plasma might assume corkscrew spiral shapes, and as they twist they act to compress everything between them.

Because Plasmas obey the laws of electromagnetism, electrostatic pressures and extreme electrical stress can cause excessive current densities on their surfaces. Although internal electrostatic forces prevent the plasma from collapsing, the layers of this plasma may begin to pinch together. In response to extreme currents, they may change shape and due to compression, may split apart. This is because the ions and electrons within the plasma have varying thermal velocities. If external electrical potential density increases—such as due to the effects of other plasmas—it may pinch the double layers of the plasmas, causing them to divide like a biological cell, causing the plasma to split, undergoing a form of plasma fissioning or plasma mitosis and cause them to give birth to additional plasmas. Likewise, internal electrostatic pressures may cause fissioning and the new pairs may be of unequal size if one has a larger vs smaller current density.

Therefore, plasmas respond to electrical and magnetic fields including those generated by other plasmas and which may cause some plasmas to separate and divide into additional cellular forms; *i.e.* plasma mitosis—as was captured on film by U.S. customs when a shape-shifting plasmoid form soared over the airport then the ocean [2]. However, rather than evidence of biology, even what appears to be “mitosis” may be purely electromagnetic.

In addition, as noted, some plasmas appear to consist of multi-mini-plasmas (albeit dozens of meters in size) which may be attached as conglomerates as their layers are multi-polar (**Figure 28**). Therefore, if these electrostatic pressures are concentrated along the surfaces where these mini-plasma attach, this may cause the mini-plasma to detach and which may move in a different direction because each will have an initial repulsive velocity outward away from each other and either an attractive or repulsive reaction to other plasma whose surface layers have a similar or opposite charge. Hence, rather than purposeful and a reflection of sentience, these “behaviors” may be merely electromagnetic phenomenon and obey “laws” of physics, electricity and electromagnetism as yet unknown.

17. Quantitative Statistical Analysis Study One: Complex Behavior

Are the plasmas/plasmoids of the thermosphere living entities? Might they constitute a fourth domain of life even if they do not possess a genome?

To quantify the behavior and interactions of these “plasmoids” and to provide additional data relevant to the question of “life” statistical comparative analyses were performed on 91 consecutive freeze-frames (T1 - T91) taken every 0.2 s (a total period of 18.2 s) from video footage of plasma-like (“plasmoids”) interacting near a “Tethered Satellite System (TSS-IR) positioned 296 Km above the Earth as recorded by Space shuttle mission STS 75.

In February 1996, the Space shuttle “Columbia” conducted experiments to determine the effects of microgravity on EM pulses transmitted into space via a “Tethered Satellite System Reflight” (TSS-IR) system positioned 296 Km above the Earth [1]-[5]. As the TSS-IR was generating EM force fields, electricity and electron beams via the tether subsequently broke but continued to transmit a continual stream of up to 3500V into the ionosphere. Subsequently, at first, approximately 16 glowing forms, of varying brightness swarmed toward and appeared adjacent to or within 24 miles of the tether. Within the next five seconds that number increased to over three dozen; and by the end of that 18 second film sequence, the number had increased to nearly 100 (**Figure 35**) many of which remain relatively stationary whereas others were converging from multiple directions toward the tether or colliding and/or merging with, and piercing other “plasmas”.

As the tether had a known dimension (approximately 12 miles long equivalent to 19.3 Km) it provided an approximate scale against which the plasmoids, their behavior and velocities could be measured and quantified. Therefore, quantitative studies were carried out on the plasmoids aggregating around the tether and on their subsequent behavior over a period of 18.2 s. Five analytical studies were carried out: (A) overall changes in density, sizes, clustering, and collisions of the “plasmoids” over the total period of 18.2 s, (B) comparison of the size distributions of the plasmoids at different times and whether statistical distributions such as the normal and log-normal could account for the size distributions, (C) the frequencies of different shapes of the plasmoids and whether shape was likely to be stable over time, (D) movement of plasmoids, estimates of velocity, and the factors that may influence their speed, and (E) the events that occurred during collisions among plasmoids

18. Statistical Quantitative Methods (Behavior)

18.1. Images

All observations and measurements were made from video footage recorded by Space shuttle mission STS 75 [3]. The original NASA film was digitized using Apple Final Cut Pro to create 91 consecutive freeze frames (T1 - T91) approximately

0.2 s apart (a total time of 18.2 s). The freeze-frame images were processed using “Fotor” image enhancement software and one or more of the following were applied: anti-blur, and adjustment of contrast, and sharpness [1] [2]. Examples of the plasmoids at the beginning and end of the 18.2 s period are shown in **Figure 1**.

18.2. Image Analysis

Images of plasmoids were analyzed using “Image J” software [100]-[102] and which has been used in various studies in Astrobiology including studies of images taken by Martian rovers [103] [104]. Each image was magnified to clearly reveal the plasmoids. Images were manipulated using brightness, contrast, sharpening, edge detection and “thresholding” to optimize the appearance of the objects and to establish their boundaries. Image J enables various aspects of the image to be quantified including density, shape, and size distribution of the plasmoids as well as estimates of distance travelled and angle of trajectory in the plane of the image. The reproducibility of these measures was tested by making several sequential estimates of the various measures on a sample of plasmoids. The degree of variation among sequential measurements was low with coefficients of variation (CV) less than 5%.

Quantification of each frame was carried out using the following procedure. First, the degree of “brightness” varied considerably among plasmas. Hence, each image was “thresholded” using the “default method” which emphasizes the brightest two-thirds of objects present and omits the dimmer one-third. It is likely that the latter may also be plasmoids, but the dimmer features are more difficult to separate from other possible phenomena and background noise. An example of the effect of “thresholding” on one of the frames (T70) is shown in **Figure 28**. Second, a grid of squares was superimposed over each frame to enable quantification and statistical evaluation (**Figure 29**). The size of the grid squares was set to provide a reasonable sample size for quantifying each frame. Hence, a grid of 60 complete squares plus partial squares was used, the dimension of each being approximately 167 pixels (6.7 Km). Third, the tether was approximately 12 miles (19.3 Km) long and this enables an approximate scale to be set to measure the plasmoids. This poses a considerable limitation on the study as only plasmoids assumed to be within the same 2D plane as the tether can be measured with any accuracy. Hence, a small plasmoid apparently located close to the tether could in reality be in deeper space especially if in successive frames, it appeared to enlarge as if approached the tether. Similarly, a larger plasmoid that in successive frames increased in size may be moving towards the Space shuttle. This problem is particularly acute when attempting to measure velocity accurately. Hence, a reasonably accurate estimate of velocity can only be made for those plasmoids assumed to be moving in the same 2D frame as the tether.

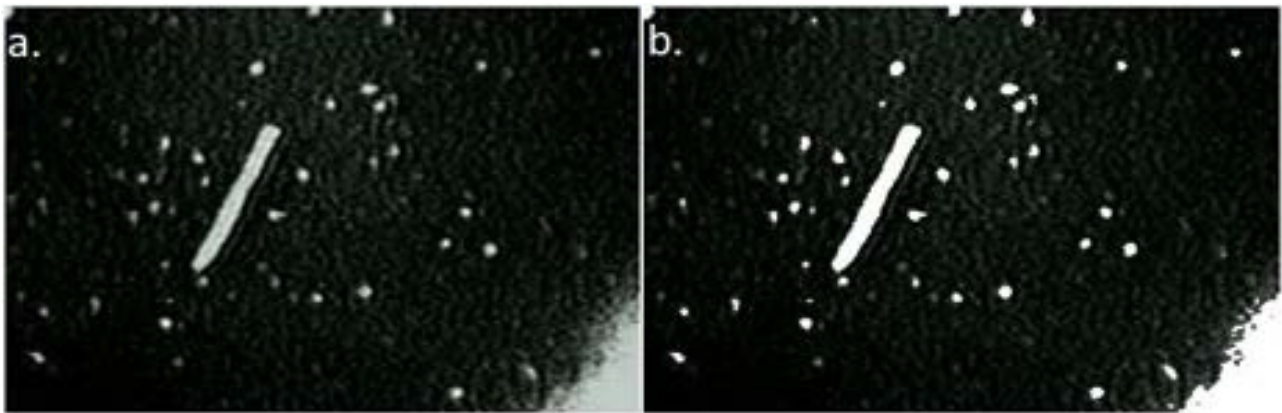


Figure 35. Effect of “thresholding” of the frame (T70) using Image J (NASA: STS115).

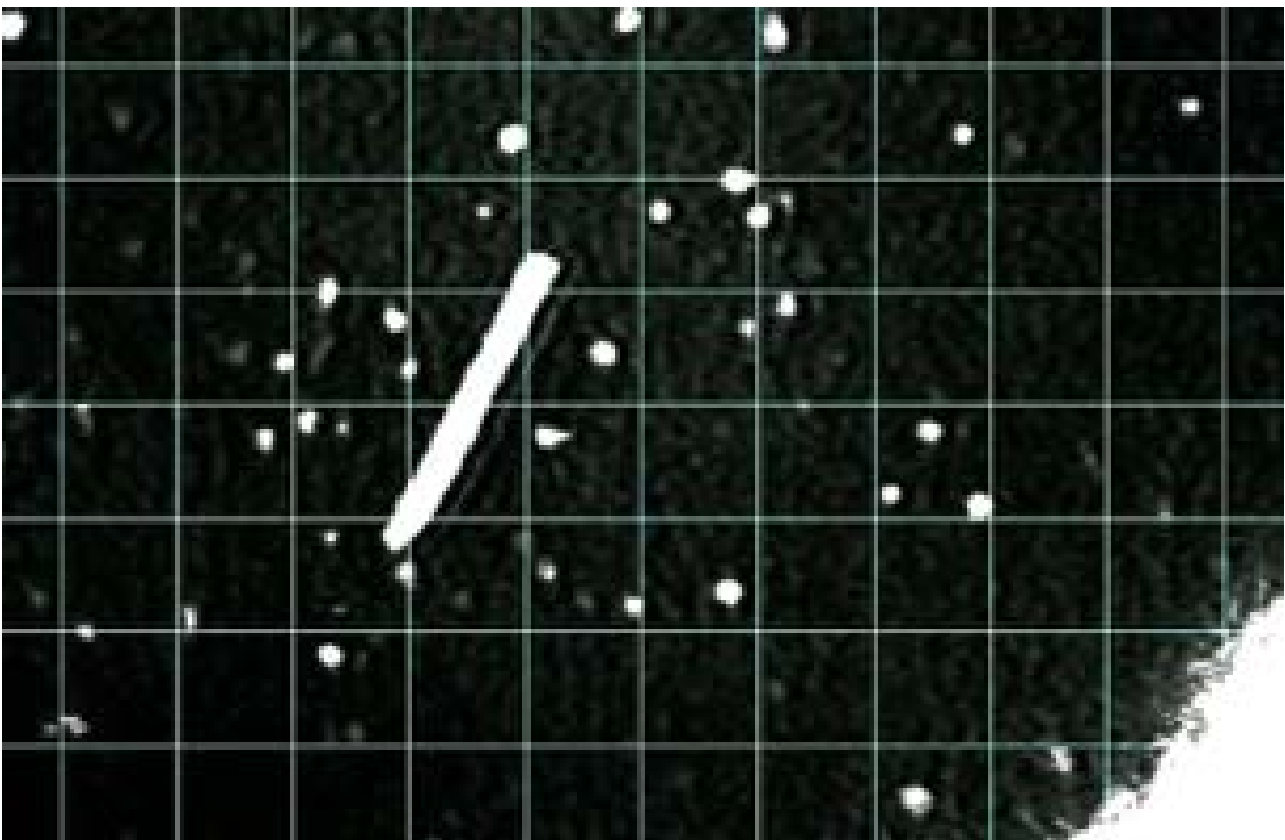


Figure 36. Superimposition of a grid over a “thresholded” frame” (T70) (NASA: STS115).

18.3. Study A: Overall Changes

To study the changes which occurred over the 18.2s of video footage, a grid (**Figure 36**) was superimposed on each of the 91 freeze-frames after “thresholding” and the following data recorded using Image-J: 1) the total number of plasmoids present within the complete squares of the grid (excluding the partial squares around the periphery of the frame), 2) the area of each plasmoid, 3) the number of new plasmoids that appeared and the number that disappeared during

each successive 0.2s interval (“gains” and “losses”), and 4) the number of collisions that occurred between plasmoids. Assessment of collisions is complicated by the fact that one plasmoid moving behind another may mimic a collision. Hence, additional evidence of collision such as arrested movement, obvious fusion, or the formation of a dust trail [1] [2] were required to count a “collision event”. First, the data were analyzed using linear regression and correlation methods to determine whether there were significant linear increases in the variables measured with time. Second, examination of the raw data identified fluctuations in virtually every variable measured. To examine these fluctuations, the data were analyzed by “time-series” analysis using single spectrum (Fourier) analysis [104]-[106] using STATISTICA software [107]. Spectrum analysis explores whether there are cyclical patterns in the data with time and the specific objective is to “decompose” a complex sequence of contiguous data into a few underlying sinusoidal functions.

18.4. Study B: Size Frequency Distributions of Plasmoids

Plasmoid areas (Km^2) were measured at five-time intervals during the 18.2 s period (at T1, T20, T40, T60, and T82) and the mean, median, and modal areas, area range, and standard deviations (SD) obtained. These measurements included all the plasmoids within the frame including those in the partial squares to increase sample size. In addition, the degree of skew and kurtosis of the various size distributions of the plasmoids were tested [108]. Discrete terrestrial entities often conform to a characteristic statistical distribution. Hence, many measurements made on biological entities, for example, exhibit a normal or Gaussian distribution [108]. By contrast, the distribution of the ages and sizes of organisms in a population may also fit a log-normal distribution [109] which has been used to describe the size distributions of many plant and animal species as well as non-biological entities [102]-[104] [110]-[112]. Three distributions were fitted to the size distributions of the plasmoids at each of the five-time intervals, viz., the normal, log-normal, and exponential distributions, the latter because of the rapid decline in frequency with increasing size.

18.5. Study C: Shapes of Plasmoids

At least four plasmoid morphologies have been observed: spiral-cylindrical, cloud, donut (nucleated), and bulbous cone have been identified and based on behavior have been characterized as “Hunters” “Grazers” and “Floaters” the later remaining relatively stationary [1]-[3]. Thunderstorm Divers were not evaluated.

Examination of the “threshold” plasmoids present over the 18.2s period indicates there may be at least seven subtypes which engage in various behaviors: sphere, ellipse, wedge, bottle, reniform (kidney-shaped), cylindrical, and diamond-shaped. The total number of occurrences of these seven types were made on each of the 91 frames and summed. In addition, to determine whether plasmoid morphology varied with time, frequencies were obtained for six intervals of time (T1 - T15, T16 - T30, T31 - T45, T46 - T60, T61 - T75, T75 - T90) which were

compared using chi-square (χ^2) contingency table tests. Joseph *et al.* [1] [2] also identified a number of circumstances in which the plasmoids appeared to change in shape (“shape-shifters”).

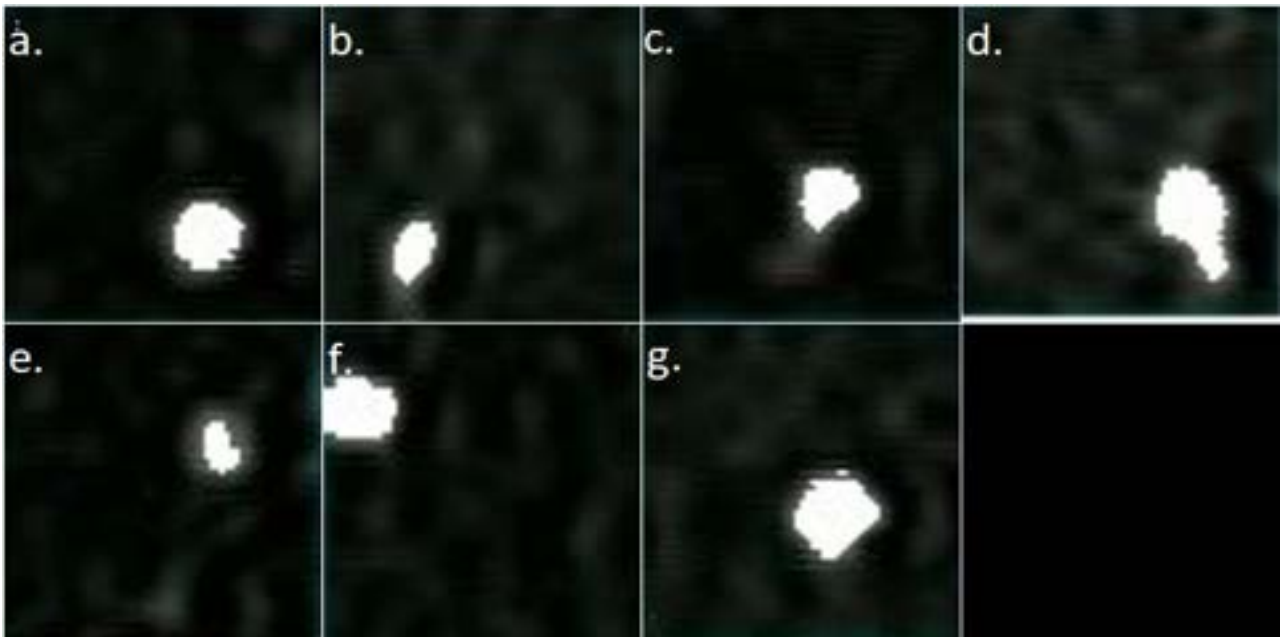


Figure 37. Classification of plasmoid morphology: (a) sphere, (b) ellipse, (c) wedge, (d) “bottle”, (e) reniform, (f) cylinder, (g) diamond (NASA: STS75).

To test this hypothesis, a number of individual plasmas which remained similar in overall area were followed over successive frames and their ratio of vertical length to horizontal width (L/W ratio) measured on each occasion.

18.6. Study D: Movement, Velocity, Behavior

It has been observed that some plasmoids appeared to be stationary for long periods whereas others moved at variable velocities, some at high speeds [1]-[5]. In addition, observation of successive frames suggested that the same plasmoid may appear and disappear, sometimes several times, over the 18.2 s period. To study these phenomena, 30 individual plasmoids were followed over the whole of the 18.2 s period, or if only present for part of that time, from the time of appearance to disappearance. The following data were obtained: 1) the number of 0.2 s intervals in which a plasmoid was consistently present, 2) the percentage of 0.2 s intervals the “plasmoid” either moved or was stationary, 3) the number of gaps in the sequence, *i.e.*, intervals in which a plasmoid disappeared before reappearing, and 4) the mean length of the gaps between their disappearing and reappearing.

Measuring the velocities of individual plasmoids accurately is difficult but making a number of assumptions, rough estimates can be made. The assumptions made were first, that the tether and associated plasmoids form a reasonable approximation to a 2D frame of reference, second, that 19.3 Km is a reasonably accurate approximation to the length of the tether and third, that if a plasmoid

moves consistently up or across the frame without changing significantly in area, then it is probably moving within a 2D frame relatively close to the tether.

Nevertheless, plasmoids may move in a 2D plane, but be located some distance below or above the tether, and in these circumstances, velocity will either be underestimated or overestimated respectively. If a plasmoid is moving towards the tether from deeper space or out of the frame towards the camera, no estimate of velocity can be made. Seven plasmoids moving in a 2D plane were followed for varying periods and changes in position and trajectory in successive periods used to estimate acceleration and velocity.

18.7. Study E: Collisions

It has been observed that plasmoids that collided with others, then turned 45° , accelerated, and struck others. Such encounters often resulted in a glowing plasma “dust-like” trail, evident even when the two plasmoids involved moved apart [1]-[3]. Measuring change in velocity, trajectory, and shape following these encounters is particularly difficult as both partners need to be moving in the same plane of the field and also not to change significantly in area. Four such encounters were studied over successive frames including intervals before and after the collision. In each frame, the position, angle of trajectory, and L/W ratio were recorded.

19. Results: Behavioral Analysis

19.1. Study A: Overall changes

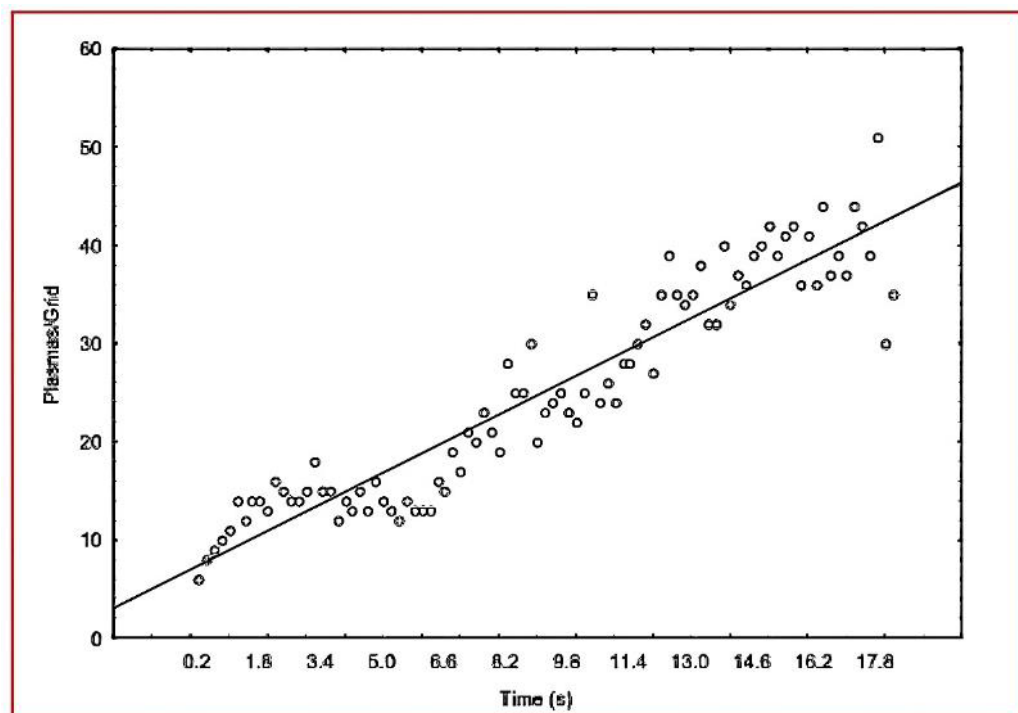


Figure 38. Density of plasmoids (Total number in all complete grid squares) in each 91, 0.2 s interval (Regression line: $Y = 6.97 + 1.97X$; $r = 0.94$; $r^2 = 0.88$).

The density of “threshold” plasmoids increased linearly over 18.2s from 6 - 51 “plasmoids” per grid (**Figure 5, Table 1**). Although the linear regression was highly significant ($r = 0.94$, $r^2 = 0.88$), there was considerable fluctuation about the line. The difference in the number of plasmoids in successive 0.2 s intervals, however, was not linearly related to time ($r = -0.06$, $P > 0.05$) indicating a relatively uniform change in numbers over time. Nevertheless, both the number of “gains” between successive 0.2s time intervals (0 - 12) and the number of “losses” (0 - 21) were weakly correlated with time (gains: $r = 0.33$, $P < 0.05$); losses: $r = 0.33$, $P < 0.05$). The intensity of clustering of the plasmoids around the tether (as measured by the V/M ratio) varied from 0.79 (essentially random) to 2.79 (highly clustered) but the degree of clustering did not correlate significantly with time ($r = 0.16$, $P > 0.05$). Mean area of plasmoids per frame varied from 0.20 - 0.73 Km² but change in mean area was not correlated with time ($r = 0.02$, $P > 0.05$). Similarly, minimum area of plasmoids per frame was unrelated to time ($r = -0.14$, $P > 0.05$) but maximum area was significantly correlated with time ($r = 0.50$, $r^2 = 0.25$) indicating either the acquisition of more larger-sized plasmoids later in the period or growth in area of individual plasmoids already present. The number of verifiable collisions per 0.2s interval varied from 0 - 2 and was weakly correlated with time ($r = 0.39$, $P > 0.05$, $r^2 = 0.15$) indicating that more collisions occurred when the plasmoids were more numerous.

Table 1. Changes in density of plasmoids over 18.2 s interval divided into 91, 0.2 s intervals following detachment of the satellite tether: Fit to a linear model.

<i>Variable</i>	<i>Pearson's correlation coefficient (r)</i>	<i>Regression</i>
Density of plasmoids per grid	$r = 0.94$, $P < 0.001$, $r^2 = 0.88$	$Y = 6.97 + 1.97X$
Difference in numbers between successive 0.2 s intervals	$r = -0.06$, $P > 0.05$	-
Gains per 0.2 s interval	$r = 0.33$, $P < 0.05$, $r^2 = 0.11$	$Y = 1.02 + 0.16X$
Losses per 0.2 s interval	$r = 0.33$, $P < 0.05$, $r^2 = 0.11$	$Y = 0.44 + 0.19X$
Mean area of plasmoids per frame	$r = 0.02$, $P > 0.05$	-
Minimum area of plasmoids per frame	$r = -0.14$, $P > 0.05$	-
Maximum area of plasmoids per frame	$r = 0.50$, $P < 0.01$, $r^2 = 0.25$	$Y = 1.86 + 0.04X$
Clustering of plasmoids per frame	$r = 0.16$, $P > 0.05$	-
Number of collisions per frame	$r = 0.39$, $P < 0.05$, $r^2 = 0.15$	$Y = -0.10 + 0.03X$

Examination of the trends over time showed that despite a number of linear changes being detected, the data also suggested that many variables fluctuated over relatively short periods, with some apparently exhibiting a cyclic pattern. The results of the single spectrum (Fourier) analysis are shown in **Table 2**. A Fourier analysis of the densities of plasmoids per grid (**Figure 6**) shows that despite the overall linear trend, numbers fluctuated in a cyclic pattern at three different fre-

quencies, *i.e.*, at very short (0.2 s) intervals, intermediate (2 s), and at a larger scale (6 s). Hence, the process of recruitment of the plasmoids around the tether was complex and cyclical; the short-term fluctuations possibly representing rapid changes in illumination of the plasmoids while the larger fluctuations may represent the regular appearance of groups of plasmoids. Similar complex fluctuations were shown by other variables such as maximum area of plasmoid, their degree of clustering, and differences in density between successive time intervals (**Table 2**).

Table 2. Single spectrum (Fourier) analysis of the various changes in plasmoids over 91, 0.2s intervals (KS = Kolmogorov-Smirnov goodness-of-fit test, LC = Linear correction applied, * Significant deviation from negative exponential distribution).

<i>Variable</i>	<i>KS</i>	<i>LC</i>	<i>Number of peaks</i>	<i>Frequencies</i>
Density of plasmoids per grid	0.30*	+	3	1 - 2, 10, 30
Difference in numbers between successive 0.2 s intervals	0.39*	-	1	3
Gains per 0.2 s interval	0.13	+	-	-
Losses per 0.2 s interval	0.19	+	-	-
Mean area of plasmoids per frame	0.15	-	-	-
Minimum area of plasmoids per frame	0.05	-	-	-
Maximum area of plasmoids per frame	0.36*	+	4	2, 6, 10, 45
Clustering of plasmoids per frame (V/M)	0.24*	-	4	2, 8, 15, 45

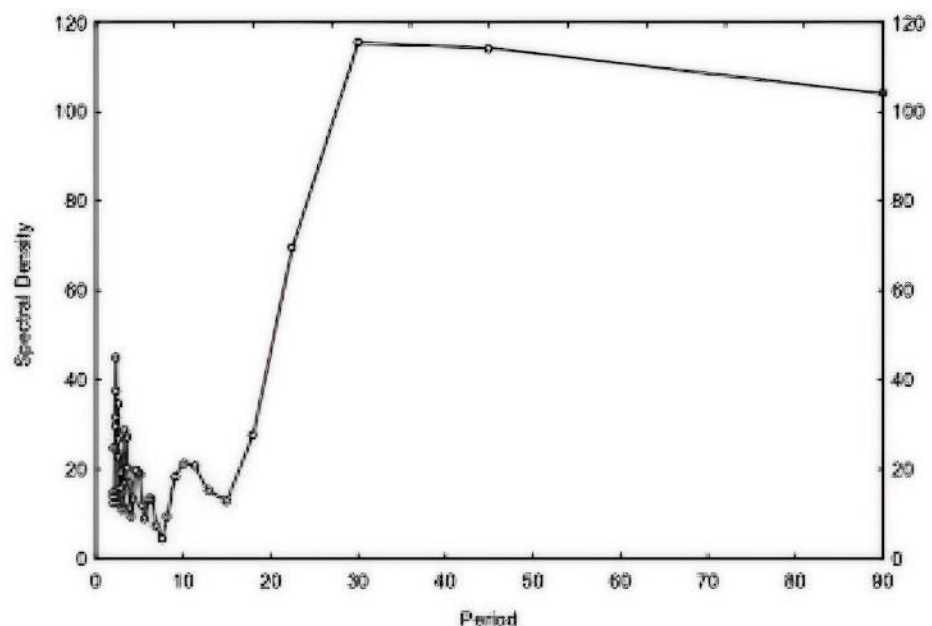


Figure 39. Single spectrum (Fourier) analysis of the changes in density of plasmoids over 91, 0.2 s intervals showing three peaks of repeating density at 1 - 2, 10, and 30 0.2 s intervals.

19.2. Study B: Size Frequency Distributions of Plasmoids

Table 3. Descriptive statistics for plasmoid size distributions at five times during the 18.2 s period analyzed (N = Number of plasmoids, SD = standard deviation, M = Multiple, * Significant skew or kurtosis).

Frame	N	Mean	Mode	Range	SD	Skew	Kurtosis
T1	12	0.58	0.34	0.01 - 1.93	0.63	1.06	0.29
T20	33	0.45	0.12	0.01 - 0.55	1.06	1.06	-0.17
T40	41	0.51	0.32	0.01 - 1.90	0.53	0.89	-0.12
T60	54	0.60	0.41	0.01 - 2.33	0.66	1.18*	0.53
T82	120	0.05	M	0.01 - 2.68	0.58	2.12*	4.14*

Study A showed that there were no overall changes in mean area of plasmoids over the 18.2 s period but more detailed analysis indicated some change over time. Plasmoid area statistics at five selected times (T1, T20, T40, T60, T82) are shown in **Table 3**. Plasmoids ranged in size at the selected times from 0.01 - 2.68 Km² but the largest plasmoid recorded at any time was approximately 4 Km² (T61). Although mean area of plasmoids was fairly consistent over the five periods, there was a decline in mean area at T82. The distributions of plasmoid size were not significantly skewed or exhibited kurtosis on T1, T20, and T40 but a significant degree of positive skew was present later in the period at T60 and T82.

Table 4. Size frequency distributions of the plasmoids at five times during the 18.2 s period. Size classes are upper limits in Km².

Frame	Size classes (upper limits) (Km ²)						
	<0.09	0.57	1.06	1.54	2.03	2.51	>2.51
T1	4	3	2	1	1	0	1
T20	15	6	1	5	3	2	1
T40	17	5	8	6	2	2	1
T60	9	20	11	7	2	3	2
T82	73	19	13	6	6	1	2

The size frequency distributions of the plasmas at the five times are shown in **Table 4** and illustrated at T82 in **Figure 7**. **Figure 7** shows a highly skewed distribution with a preponderance of small plasmoids which may represent either smaller plasmoids close to the tether but more likely, plasmoids that may be moving towards the tether from deeper space. The size distribution on T82 was not fitted significantly by a normal, log-normal, or exponential distribution.

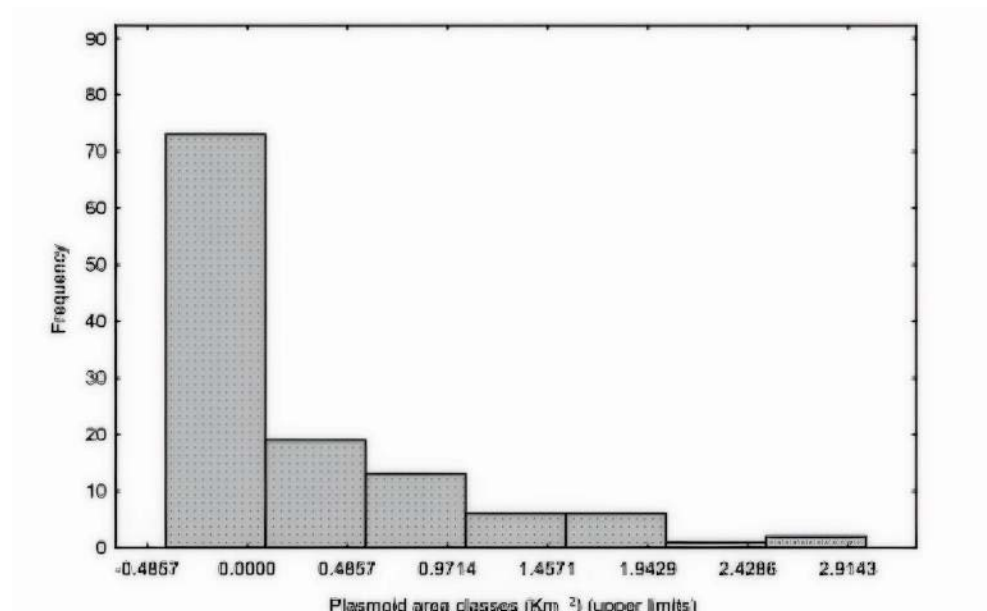


Figure 40. Size frequency distribution of plasmoid area (Km²) at T82 showing a preponderance of small plasmoids and rapidly decreasing frequency with increasing area.

19.3. Study C: Shapes of “Plasmoids”

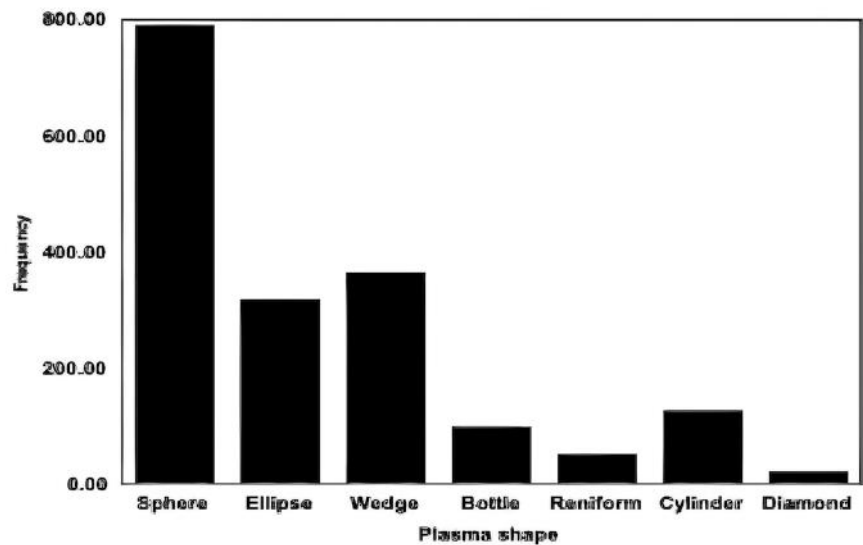


Figure 41. Frequency distribution of plasmoid shape (all records summed over 91, 0.2 s time intervals).

The frequency distribution of the seven categories of shape summed over all 91 frames is shown in **Figure 8**. The approximately spherical shape was the most common (44.5%) followed by wedge (21%), and elliptically-shaped plasmoids (18%). The distribution of the shapes, however, varied with time (**Table 5**) ($\chi^2 = 187.33$, $DF = 25$, $P < 0.001$), a higher proportion of spherical shapes being present later in the period.

Table 5. Frequency distribution of different shapes of plasmoid at different time intervals
Chi-square (χ^2) = 187.33 (25DF, $P < 0.001$)

Time interval	Shape category					
	Sphere	Ellipse	Wedge	Bottle	Kidney	Cylinder
T1 - T15	69	34	78	0	8	10
T16 - T30	69	34	55	3	7	4
T31 - T45	86	54	61	2	2	14
T46 - T60	122	66	53	27	14	23
T61 - T75	200	57	51	32	17	38
T76 - T91	245	74	65	35	4	48

Chi-square (χ^2) contingency table test: = 187.33, 25DF, $P < 0.001$.

An example of change in shape associated with movement of a plasmoid is shown in **Figure 9**. An oscillatory change in L/W ratio is evident over a period of 3 s between spherical and elliptical forms. It is possible that non-spherical shapes are associated with movement of the “plasmoids” while at rest plasmoids revert to a spherical form.

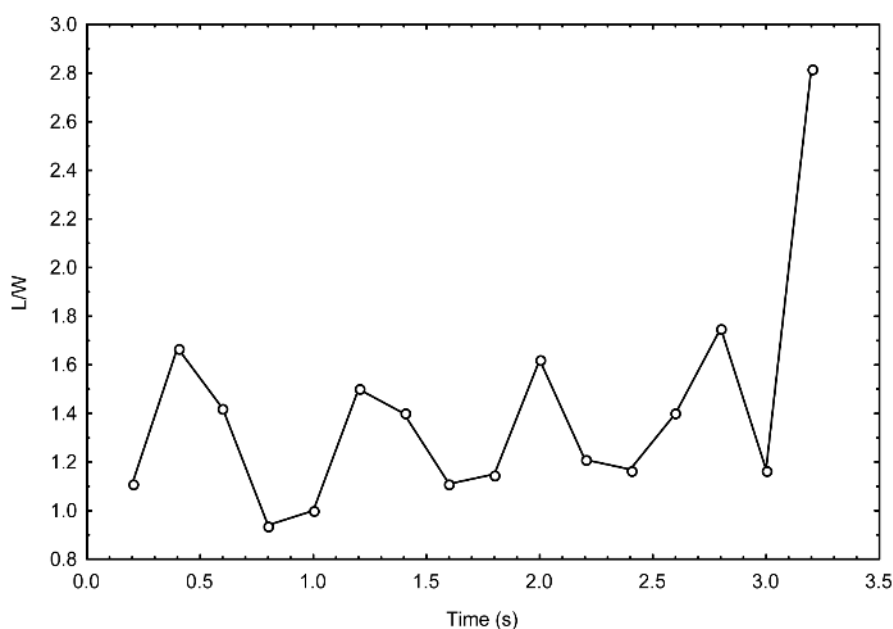


Figure 42. Oscillating change in shape (L/W ratio, L = Vertical dimension, W = Horizontal dimension) of a moving plasmoid

19.4. Study D: Movement and velocity

The fate of 30 randomly selected “plasmoids” was followed in detail over consecutive frames from appearance to disappearance and the data are shown in **Table 6**. Plasmoids varied from those which were very short lived (present only at a single 0.2s interval) to those which persisted over the whole 18.2s period (mean

persistence was 41, 0.2s intervals). The percentage of 0.2s intervals in which plasmoids were in motion varied from 1% - 100% (mean 69%) and the corresponding percentage of intervals in which plasmoids were stationary varied from 0 - 99% (mean 31%). Hence, some plasmoids were in continual motion whereas others were essentially immobile throughout the period. The number of 0.2s intervals in which a plasmoid “disappeared” from view and then “reappeared” was in the range 0 - 6 (mean 0.4) and the length of gaps varied from 0 - 3 intervals. These phenomena could be attributable to the waxing and waning of the luminescence associated with the plasmoids as it fell below the “thresholding” level.

Table 6. Persistence and movement of a random sample of 30 plasmoids over the 18.2s interval.

<i>Variable</i>	<i>Mean</i>	<i>Range</i>	<i>SD</i>
Number of 0.2 s intervals plasmoid present	41	1 - 90	30.69
% 0.2 s intervals in which movement detected	69	1 - 100	33.39
% 0.2 s intervals stationary	31	0 - 99	33.39
Number of “gaps” in trajectory	0.4	0 - 6	1.19
Mean length of “gaps”	0.27	0 - 3	0.68

Table 7. Estimated velocities of a sample of plasmoids moving approximately in a straight line in a 2D plane.

<i>Plasmoid</i>	<i>Acceleration phase (Km·s⁻¹)</i>	<i>Constant phase (Km·s⁻¹, SD)</i>	<i>Trajectory of movement (Angle to vertical, SD)</i>
T1.1	16.25	4.40 (2.35)	85 (0.86)
T1.2	7.90	1.10 (0.90)	78 (3.52)
T1.3	12.95	2.05 (1.45)	91 (2.79)
T1.4	19.10	1.90 (0.90)	94 (1.20)
T3.1	11.30	2.45 (1.20)	13 (3.77)
T3.2	15.35	3.90 (2.0)	85 (0.41)
T72.1	35.55	20.75 (6.10)	78 (0.97)

The movement of seven, initially stationary plasmoids moving more or less in a straight line within the plane of the frame was studied in detail (**Table 7**). All showed evidence of an initial period of rapid acceleration (7.90 - 35.55 Km·s⁻¹) followed by a lower more fluctuating velocity (1.1 - 20.75 Km·s⁻¹). All with one exception (plasmoid T1.3) showed trajectory angles with low SD indicating that once movement was commenced, the plasmoid remained more or less in a straight line. A good example of this pattern is illustrated by plasmoid T1.1 (**Figure 10**) which showed a period of rapid acceleration (16.25 Km·s⁻¹) followed by a more “constant phase (4.4 Km·s⁻¹). Nevertheless, even within the constant phase, there were considerable fluctuations in velocity indicating a “jerky” type of movement.

An exception to this pattern is plasmoid T1.3 (**Figure 11**) which after initial acceleration travelled at a more or less constant but fluctuating speed for 40, 0.2 s intervals before making a sharp 163° turn and then traveling at an increasing speed in a new direction before leaving the frame. There were no visible features within the frame which could account for this sudden change in direction.

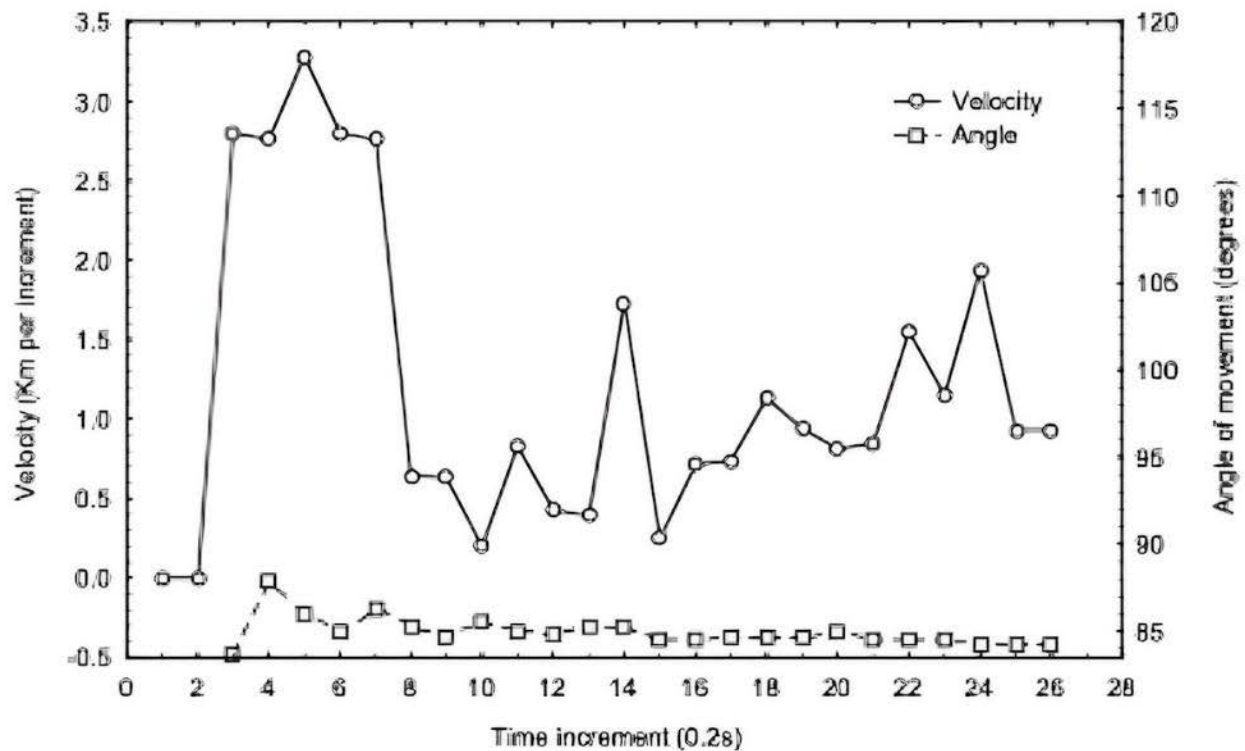


Figure 43. Estimated velocity ($\text{Km}\cdot\text{s}^{-1}$) and trajectory (angle from vertical) of plasmoid T1.1 showing a period of rapid acceleration ($16.25 \text{ Km}\cdot\text{s}^{-1}$) followed by a phase in which velocity oscillated around a mean value ($4.4 \text{ Km}\cdot\text{s}^{-1}$).

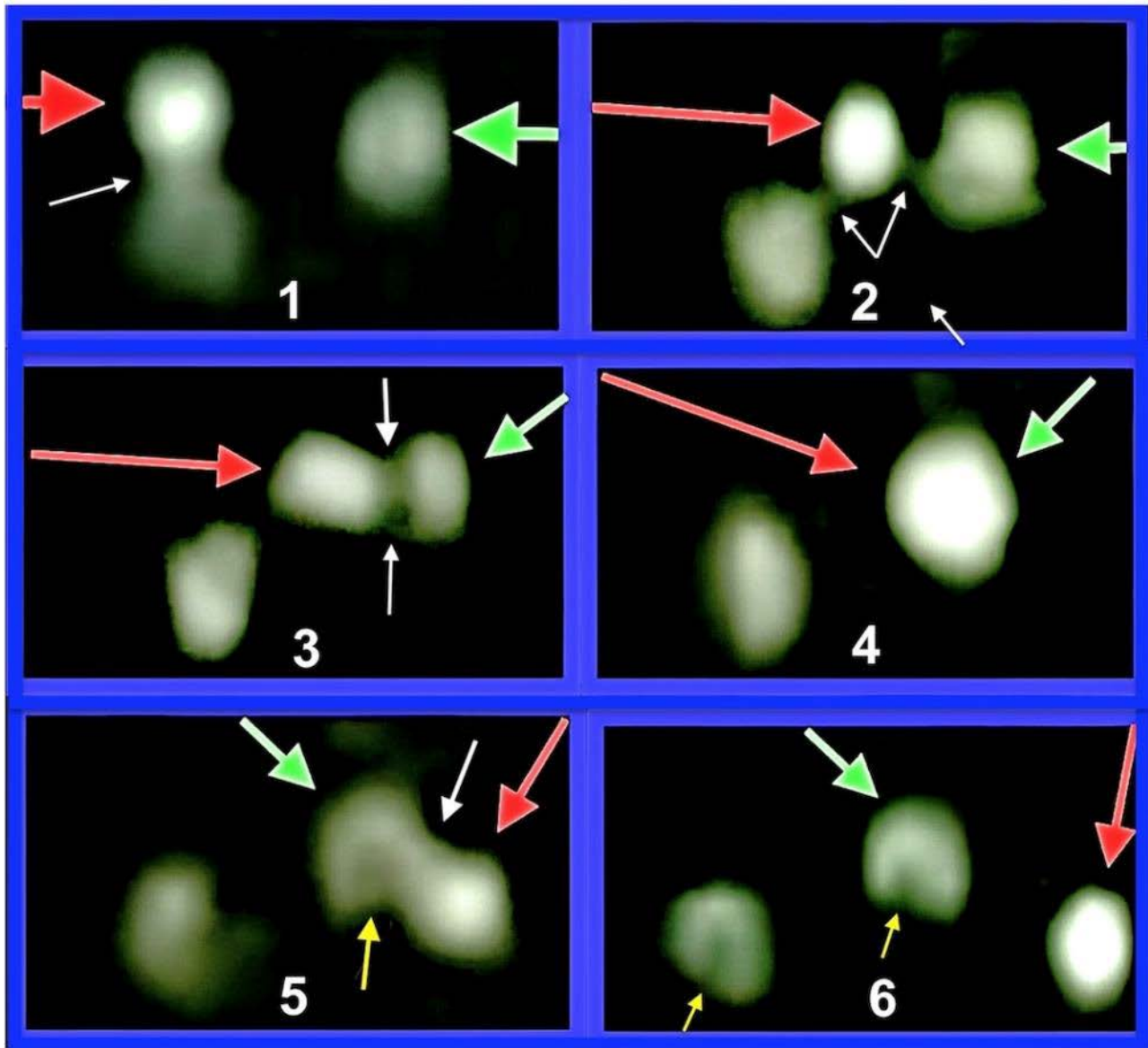


Figure 44. Colliding, merging, shapshifting plasmoids (plasmas) in the thermosphere. 1. Red Arrow-Plasmoid is attached by a thick plasmoid bridge (white arrow) to the plasmoid below it. 2. Red Arrow while maintaining a connection (white arrow) to the plasmoid below it travels toward and forms interlinking plasmoid bridge (white arrow) with Geen-Arrow Plasmoid and then 3, 4, merges with Green Arrow plasmoid, and 5,6, disconnects from Green Arrow, Note yellow arrows pointing toward similar horse-shoe shapes.

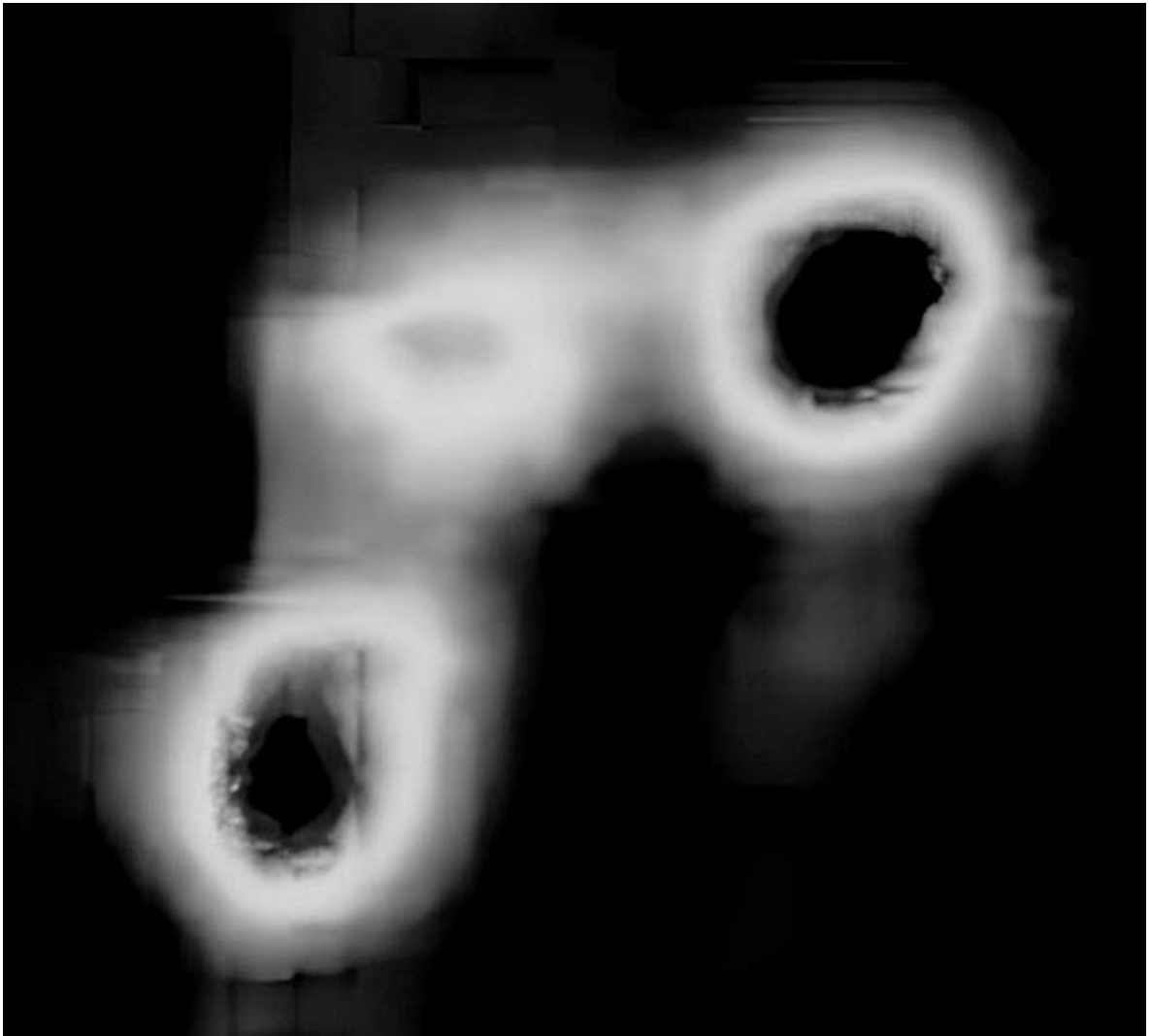


Figure 45. Donut-shaped plasmas (plasmoids) in the thermosphere linked together via thick clouds of plasma.

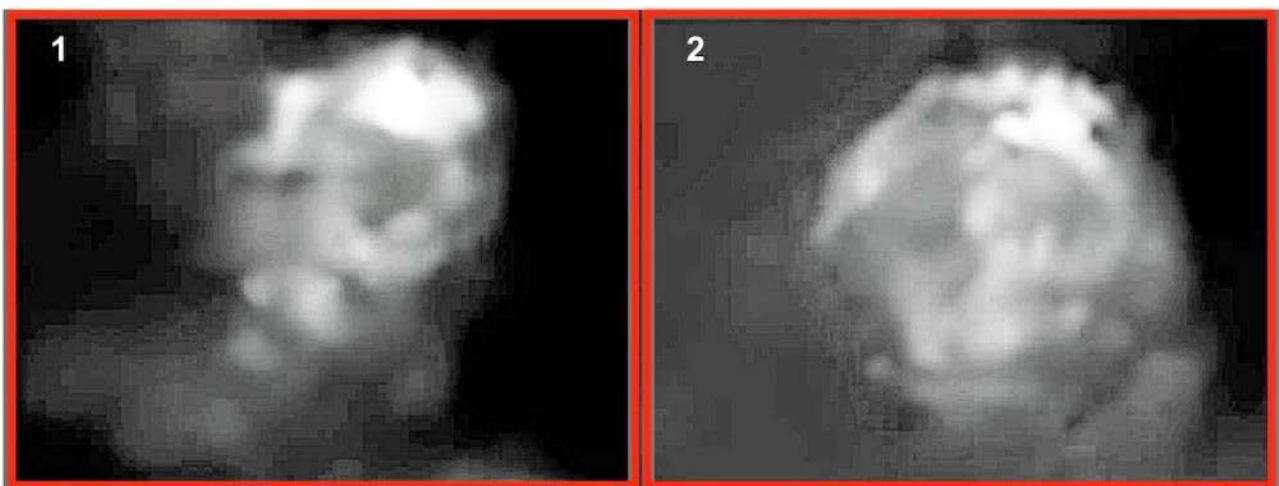


Figure 46. Plasmoid (1) is (hypothetically) in profile, and (2) turns, and is (hypothetically) facing the video-camera. Note vague clouds of plasma surrounding this specimen.

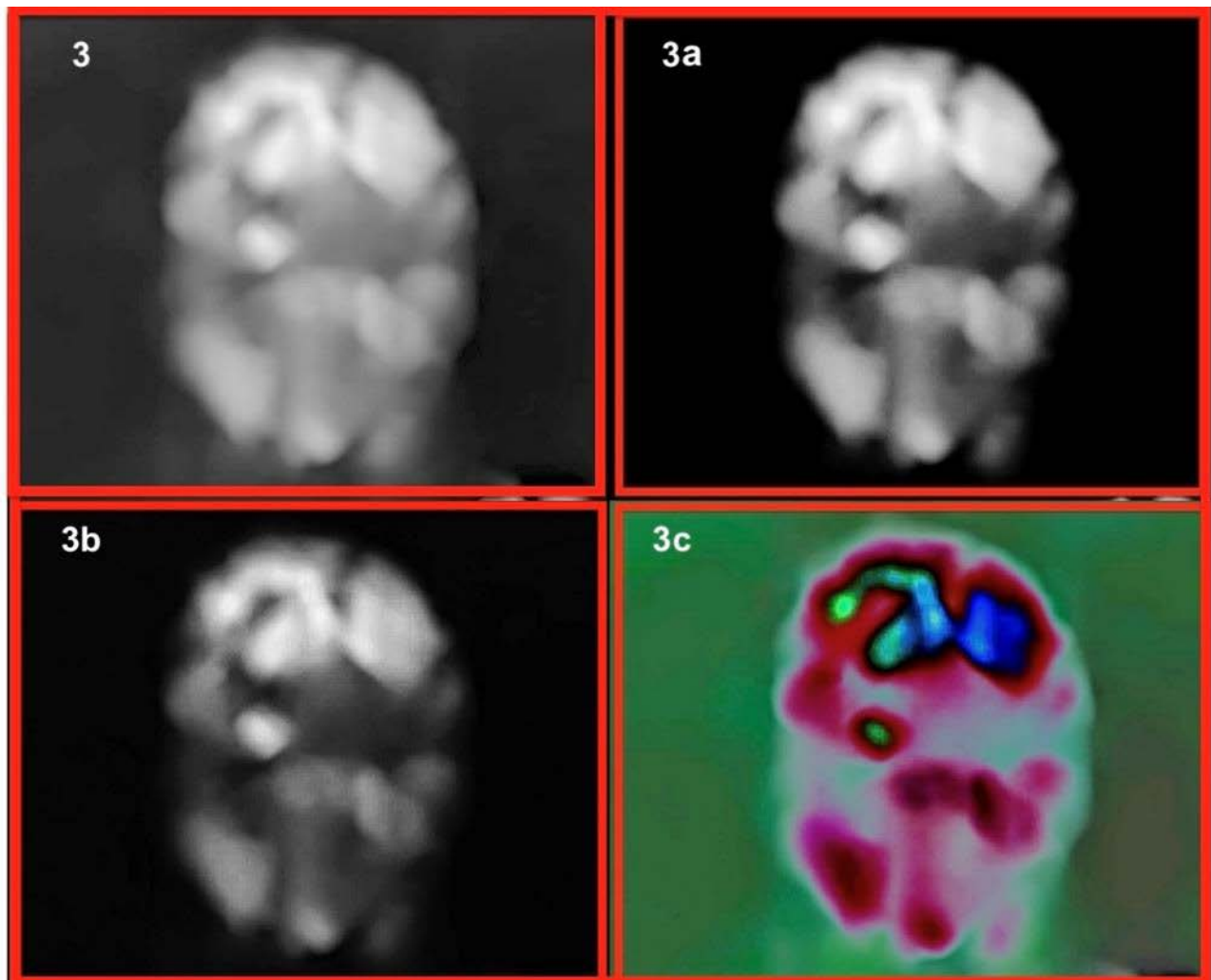


Figure 47. Continued from 1-2 (**Figure 46**). 3. Shape shifting plasmoid in motion, Filters applied to gray scales (3a, 3b, 3c) documenting plasmoids often consist of conglomerates of plasmas loosely bound together, thereby contributing to shifting shapes, and enabling individual or groups of plasmas to detached for the main body and make contact with other plasmoids.

A stepwise multiple regression analysis was performed on the 30 plasmoids to identify factors that may be associated with movement (**Table 8**). Velocity of a plasmoid was significantly related to L/W ratio ($F = 18.81$, $P < 0.002$) indicating either that more asymmetric plasmoids travelled at faster speeds or more likely, that movement distorted the shape of the plasmoid into a more elongated form. By contrast, initial or closest proximity to the tether did not appear to influence velocity. In addition, persistence of a plasmoid over 18.2 s was dependent on its width ($F = 6.88$, $P = 0.014$), indicating that the larger “plasmoids” were more consistently present.

The number of collisions occurring over 18.2 s (divided into 9-time intervals), while the plasmoids were aggregating around the tether, is shown in **Figure 12**. No collisions were observed during the first 6s after which numbers of collisions increased with time, maximum collisions being observed in the final interval. As expected, more collisions depended on plasmid density similar to gas particles in

a container.

The point of collision between pairs of plasmoids during four “collision events” is shown in **Figure 13** and the detailed course of the “T45 collision event” is shown in **Figure 14**. This collision event occurred between two plasmoids (P1, P2), one of which was moving (P1) while the other was essentially stationary (P2). The velocity of P1 increased prior to the collision which occurred at 1.6s in the sequence. After collision, P2 remained relatively unaffected while the velocity of P1 showed considerable fluctuation. In addition, P1 exhibited fluctuations in L/W ratio over the period but did not appear to be affected by the collision itself whereas P2 showed a larger change in L/W after the collision.

A summary of the four “collision events” is shown in **Table 9**. Each of the collision events was unique but all showed changes in velocity, trajectory, and/or L/W ratio as a result of the event. Hence, two events showed increasing velocities of one or both plasmoids prior to collision (T45, T72), three showed changes in trajectory before collision although one change was slight (T45, T63, T76), and two showed changes in L/W prior to collision (T45, T76). One collision event (T76) appeared to result in a thin trail of material joining the two plasmoids.

Table 8. Stepwise multiple regression analysis (“forward method”) of the 30 plasmoids summarized in **Table 6** (R = Multiple correlation coefficient, F = Variance ratio, P = Probability).

<i>Variable analysed (Y)</i>	<i>Variable selected (X)</i>	<i>R</i>	<i>R²</i>	<i>F</i>	<i>P</i>
Plasmoid velocity	L/W	0.63	0.40	18.81	0.0002
Number of 0.2 s intervals in which plasmoid present	Plasmoid width	0.44	0.20	6.88	0.014

Table 9. Summary of events taking place at four “collision events” between pairs of plasmoids (P1, P2) (L/W = Length/Width ratio).

<i>Collision event</i>	<i>Measure</i>	<i>Before collision</i>	<i>During collision</i>	<i>After collision</i>
T45	Velocity	P1 increased	P1 decreased	P1/P2 fluctuate
	Trajectory	P1 change	P1 change	P1 change
	L/W	P1 increased	P1 decreased	P1 increased
T63	Velocity	No change	P2 decreased	P1/P2 increased
	Trajectory	No change	P1 change	P2 change
	L/W	-	-	P1/P2 fluctuate
T72	Velocity	P1/P2 increased	Falls to zero	P1/P2 fluctuate
	Trajectory	P1 change	P1 change	P1 change
	L/W	No change	-	P1 decreased
T76	Velocity	No change	No change	P1 decreased
	Trajectory	P1 change	No change	P1/P2 change

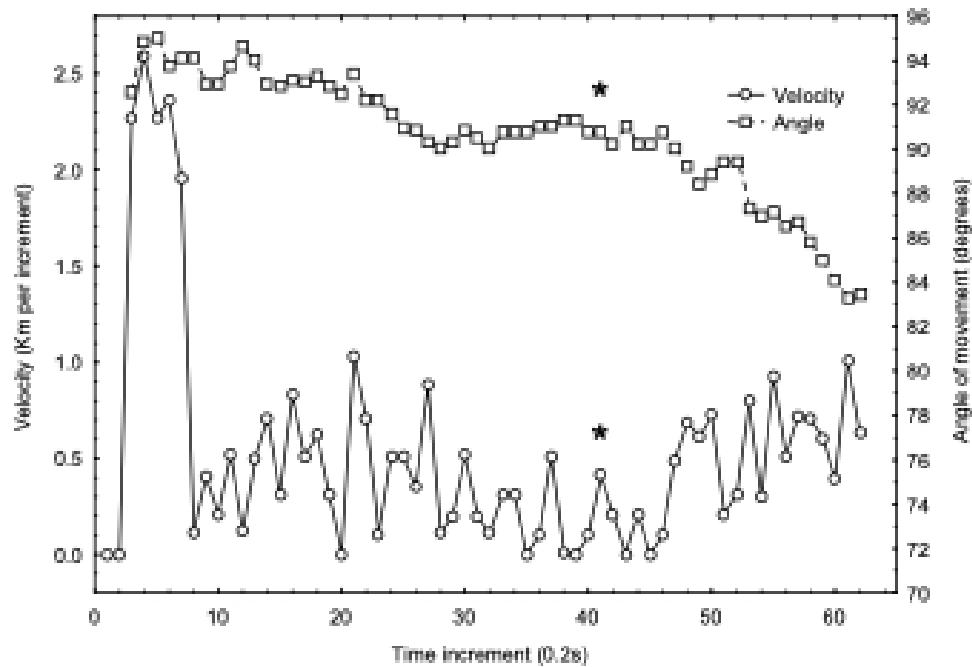


Figure 48. Estimated velocity ($\text{Km } 0.2 \text{ s}^{-1}$) and trajectory (angle from vertical) of plasmoid T1.3 which after initial acceleration travelled at a more or less constant but fluctuating speed before at the point marked (*) made a 163° turn and then travelled at an increasing speed in a new direction.

19.5. Study E: Collisions

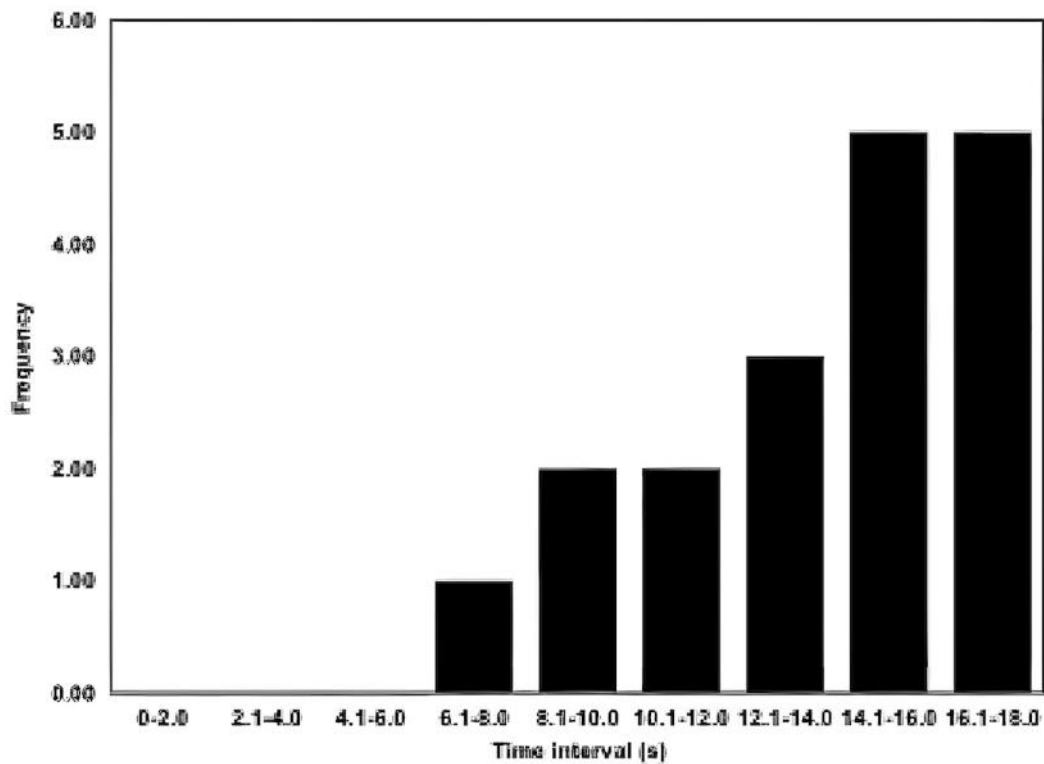


Figure 49. Frequency of collisions of plasmoids during the 18.2 s period divided into 2 s intervals.

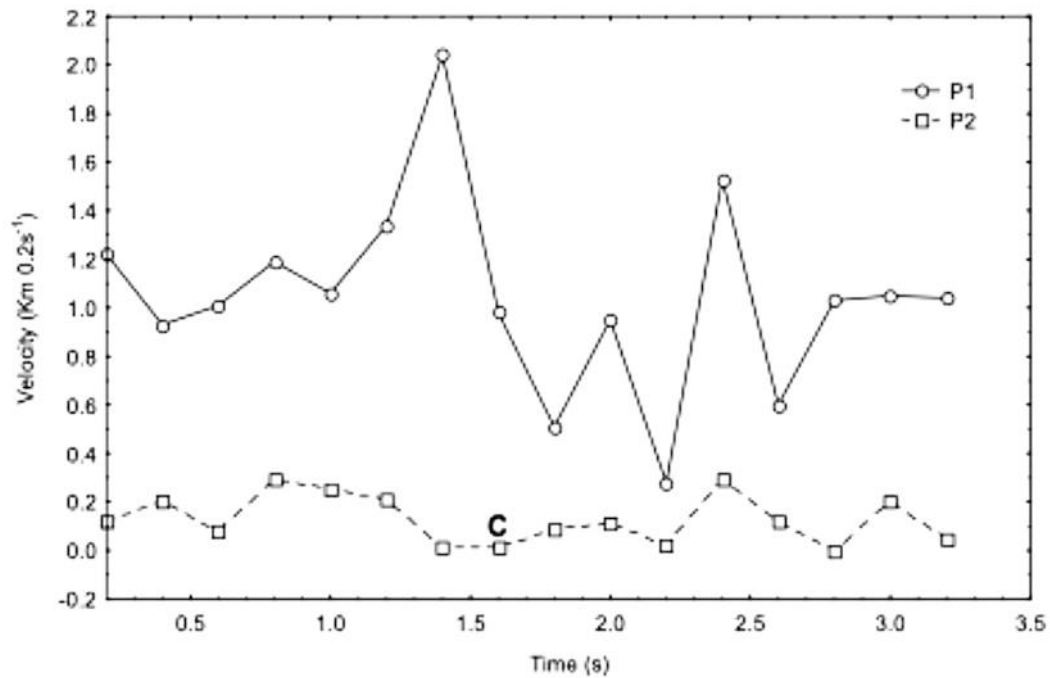


Figure 50. Changes in velocity ($\text{Km } 0.2 \text{ s}^{-1}$) of two “plasmids” (P1, P2) during the “T45 collision event”; C marks the moment of collision.

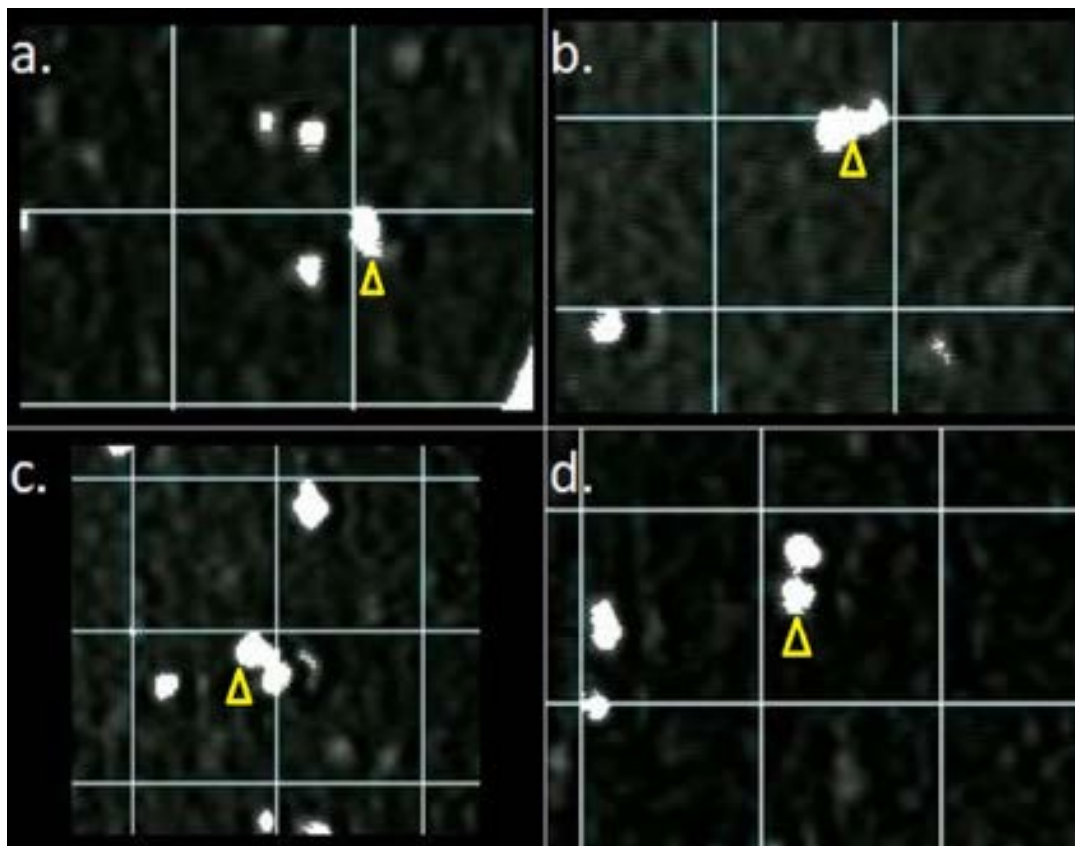


Figure 51. The moment of collision between pairs of plasmoids during four separates “collision events”: (a) T45, (b) T63, (c) T72, and (d) T76.

In addition to the plasmoid behaviors analyzed previously, an example of more complex behavior (detailed in **Figure 23**) was also studied. This behavior was filmed by mission STS80 over a period of 90 s significantly longer than the “tether incident” and adjacent to a thunderstorm. Unlike the “tether incident”, there is no physical structure present in these images which enable an approximate scale measure to be obtained and consequently, changes in movement are expressed as pixels travelled in a time interval. During this period a single plasmoid was tracked and involved in at least five “collision events” (C1 - C5) plus three events in which the plasmoid appeared to split into a number of smaller structures (Fr). After collision event C4, where the plasmoid collides with another close to thunderstorm activity, there is a gap in the record in which Image J was unable to distinguish the plasmoid from the effects of the thunderstorm.

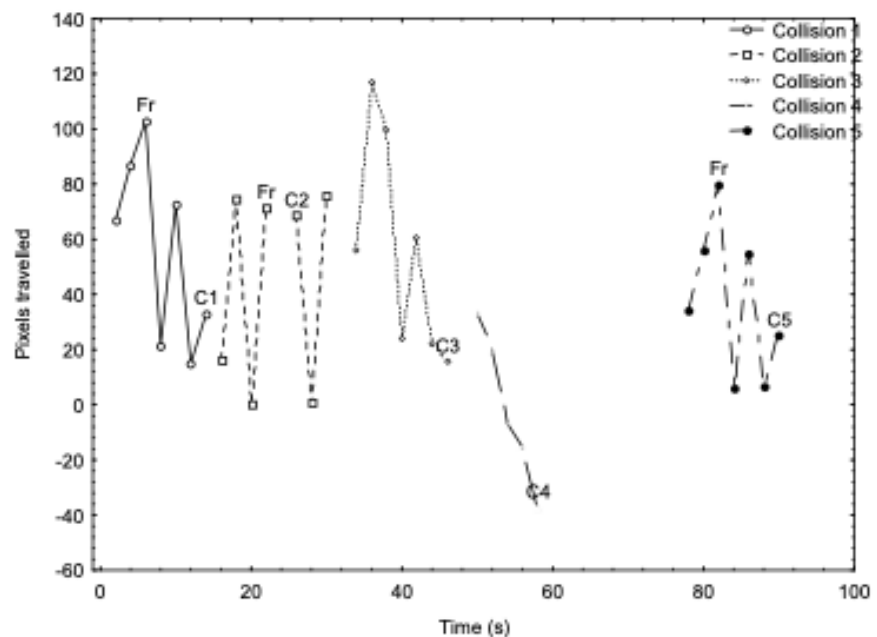


Figure 52. Movement of the plasmoid (pixels travelled per time interval) over 90 s showing the typical fluctuating pattern with five collision events (C1 - C5) and three events in which the plasmoid appeared to break up into two or more smaller structures (Fr). The gap between 58 s and 77 s corresponds to the plasmoid located close to the thunderstorm activity.

Changes in pixels travelled over 90 s is shown in **Figure 41**. During this period there are considerable changes in apparent velocity with 4/5 of the collisions accompanied by reductions in velocity prior to the collision. In addition, in collision event 4, the plasmoid reversed direction while adjacent to the thunderstorm. The data also show the fluctuating pattern of movement first detected over smaller time scales during the “tether incident”.

Changes in trajectory of the movement shown by the plasmoid over the 90s are shown in **Figure 42**. During this period, 4/5 of the collision events were accompanied by considerable changes in angle of trajectory prior to the collisions. Changes in shape (L/W) of the plasmoid during the 90s are shown in **Figure 43** most no-

table during collision events C1, C3, C4, and C5. In addition, significant changes in L/W ratio were evident prior to the fragmentation events, the plasmoid breaking up into two or more structures.

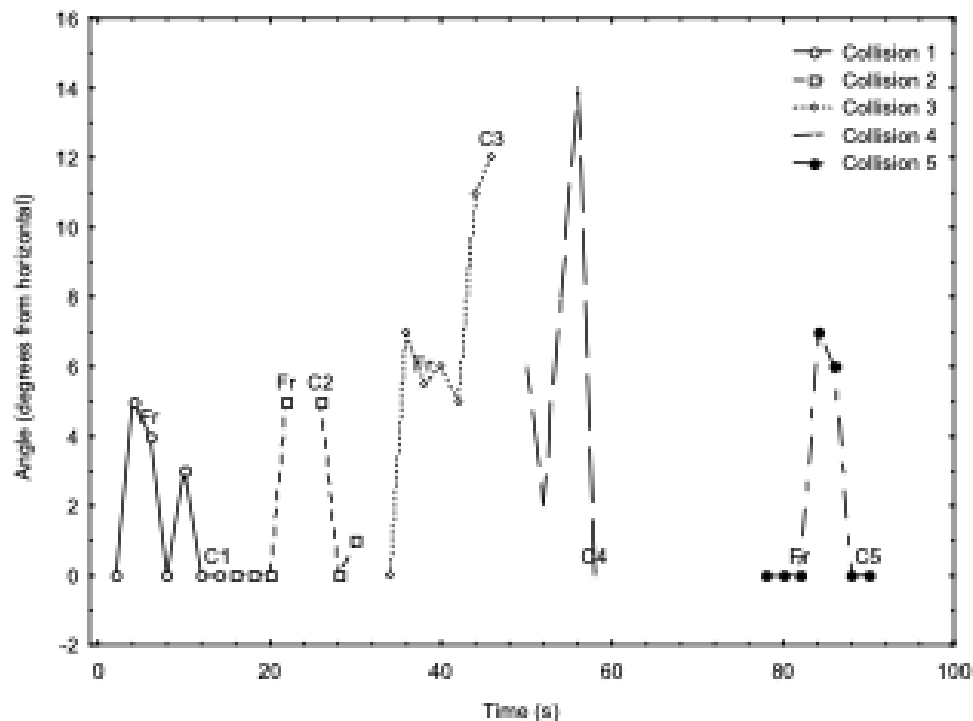


Figure 53. Changes in the trajectory of the plasmoid over 90 s showing considerable changes in angle prior to the five collision events (C1 - C5) and the three events in which the plasmoid appeared to break up into two or more fragments (Fr).

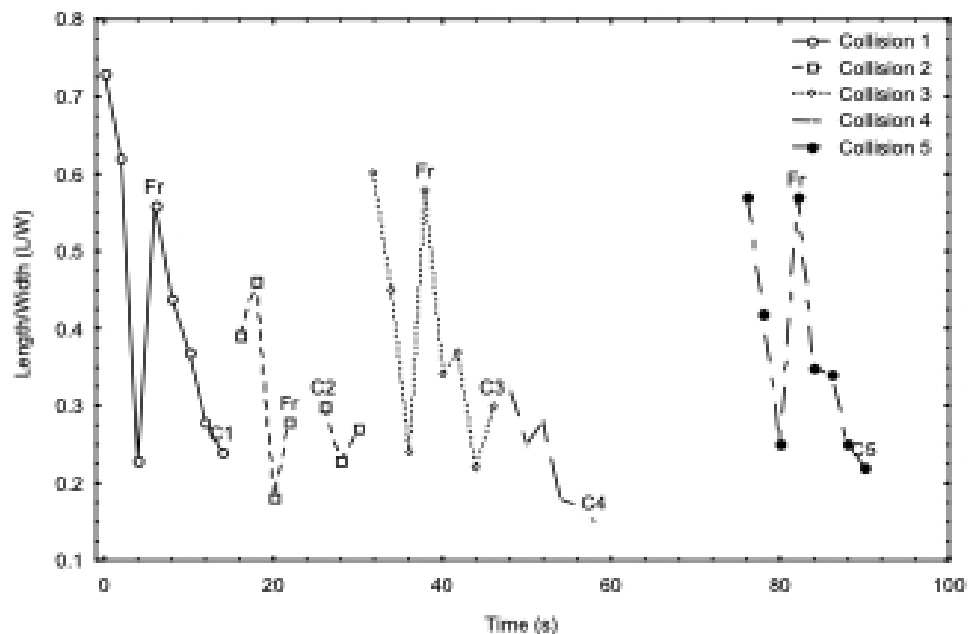


Figure 54. Changes in shape (L/W) of the plasmoid over 90 s showing considerable changes prior to the five collision events (C1 - C5) and the three events in which the plasmoid appeared to break up into two or more fragments (Fr).

20. Discussion: Quantitative Statistical Analysis of Plasmoid Behavior

This study provides a quantitative analysis of a single event involving plasmoids in the thermosphere, *i.e.*, an 18.2s period associated with the detachment of tether TSS-IR. Moreover, a variety of complex behavioral phenomena were also visible during this event including attraction to and aggregation around the tether, acceleration in a straight line to exceptional velocities (up to $35.6 \text{ Km}\cdot\text{s}^{-1}$), abrupt turns in trajectory, collisions with other plasmoids and alterations in shape and velocity. Moreover, similar, albeit less frenzied behavior and shape-shifting in the thermosphere above thunderstorms was also captured on film [3] [5].

Focusing on the tether incident; first, although plasmoids increased in number and aggregated around the tether over 18.2s, this appeared to be a complex process in which numbers fluctuated from moment to moment. Moreover, multiple plasmoids disappeared and reappeared multiple times; a phenomenon that could be related to changes in self-illumination. Numerous plasmas oscillate in brightness producing a pattern of bright then faint then bright glowing light. Given that some plasmoids may suddenly disappear and then not reappear over the remaining time period raises the possibility that they were depleted of energy and “died” or that they suddenly streaked off into deep space.

Second, “plasmoids” appear to show considerable variation in size, the largest observed having an area of approximately 4 Km^2 . The size frequency distribution of plasmoids area appears to be highly positively skewed later in the time period but it is difficult to determine whether this is attributable to actual variation in size among individuals or to their different distances from the tether. This is an important distinction as if the first hypothesis is correct, then plasmoids may have the ability to “grow” in size over time.

Third, plasmoids vary considerably in shape [1] [2] with the approximately spherical form being the most frequent. Not uncommonly movement of a plasmoid is related to changes in shape, with some, especially over thunderstorms, assuming elongated forms which contract and expand in an oscillating pattern as well as jerks, and changes in shape. These movements are reminiscent of movement through water. In fact, Alfvén [9]-[12] reports that the movements of plasmas may be “fluid-like” as if passing through currents of water whereas Marino and Sorriño-Valvo [13] described movement as “if in water” with properties similar to gases.

In addition, velocity of a plasmoid appears to be related to L/W ratio, with faster moving plasmoids being more asymmetrical. It is possible that movement distorts the overall shape of the plasmoid; as is evident when cone-shaped plasmas oscillate in size and brightness, but at rest it settles to a more stable, spherical form which encloses a fixed volume via surface tension, a form which minimizes its surface area for a specific volume [112].

Fourth, there are considerable problems in measuring velocity accurately and hence, all of the data should be regarded as approximations of the order of mag-

nitude of the speeds at which the plasmoids were moving. Velocity varied considerably among plasmoids with those measured from a standing start showing first, a period of very rapid acceleration over the first half a second, followed by a lower more stable velocity. Nevertheless, this “stability” is illusory with considerable fluctuations around the mean, *i.e.*, movement of the plasmoid is essentially “jerky”. The data also suggest that although plasmoids can travel more or less in straight lines, they also have a considerable ability to change trajectory; in one measured example, up to 163° . These changes in trajectory appear to be directed so as to insect other adjacent plasmoids. Another feature of the data is that although the tether clearly influenced aggregation of the plasmoids, it appeared to have little effect on movement of adjacent plasmoids, whereas others appeared from different directions and appeared to directly contact the tether.

Fifth, collisions among plasmoids were frequent [1]-[5]. The frequency of collisions depends on density but individual collisions are accompanied by considerable changes in the trajectory and velocity of colliding plasmoids. Each of four collision events studied was unique but changes in velocity, trajectory, and/or shape were evident.

On specific plasma among group of plasmas near the tether and showing relatively little movement, was pierced by four different plasmas coming from different directions, three of which were moving at a rapid velocity, whereas the fourth had been adjacent and unmoving until the final few seconds [3]. Likewise, in **Figure 4**, one plasma changed direction and merged with and sequentially intersected four different plasmas that remained relatively stable and unmoving.

As noted, plasmas will eject what resembles streams of bright cloudy particles in their wake both before and after they collide. A small-scale example of this phenomenon can also be observed in **Figure 13** (T76 collision event), which results in a thin trail of material joining the two plasmoids. This “dust trail” could be the physical consequences of material being removed as a result of the collision or more speculatively, that it involves a transfer of material from one “plasmoid” to another.

In addition, some will secrete, eject, or create a “messenger” plasma that will interact with other plasmas, often triggering a response such that the plasma contacted with travel toward and make contact with an adjacent plasma or the plasma that ejected the “messenger” plasma (**Figure 3**). In yet another sequence, a plasma that had intersected other plasmas, turned and followed a plasmoid coming from another direction, which in turn appeared to release a small mini-plasma in its wake which approached the plasma that was following which reversed course and headed in the opposite direction.

Therefore, it is reasonable to ask: are these complex behaviors “purposeful” and indicative of a fourth domain of life (a hypothesis favored by these authors) or are they merely “push pull” electromagnetic phenomenon? Yet another possibility: some are “alive” others are not.

21. Quantitative Statistical Analysis Study Two: Plasmoid Morphology

In order to further study plasmoid morphology and variation, and establish the possible relationships among those with differing shape and size, we employed “Deep Learning” (DL) to analyze the images. DL employs a machine learning pattern recognition “algorithm.” As data and new data are processed, the algorithm “learns” to optimize its various operations, thus gradually improving its performance and accuracy. Hence, the objective of this article was to apply DL to a sample of 32 images of individual plasmoids and to address the following questions: 1) how many distinct types of plasmoid were there within the sample, 2) how were the different morphological types related, 3) do the analyses suggest a hypothesis regarding the formation and subsequent development of the plasmoids?

Based on these results, we performed additional analyses employing “Hierarchical clustering (HC)” and “Multidimensional scaling (MDS).” As will be detailed, these quantitative analysis confirmed that the majority of the plasmoids exhibit distinct and complex morphologies and many are comprised of aggregations of spherical or more irregular-shaped plasmoid subunits (“botryoidal”) whereas others were cloud-like, amorphous and/or had a single condensed, sculpted form.

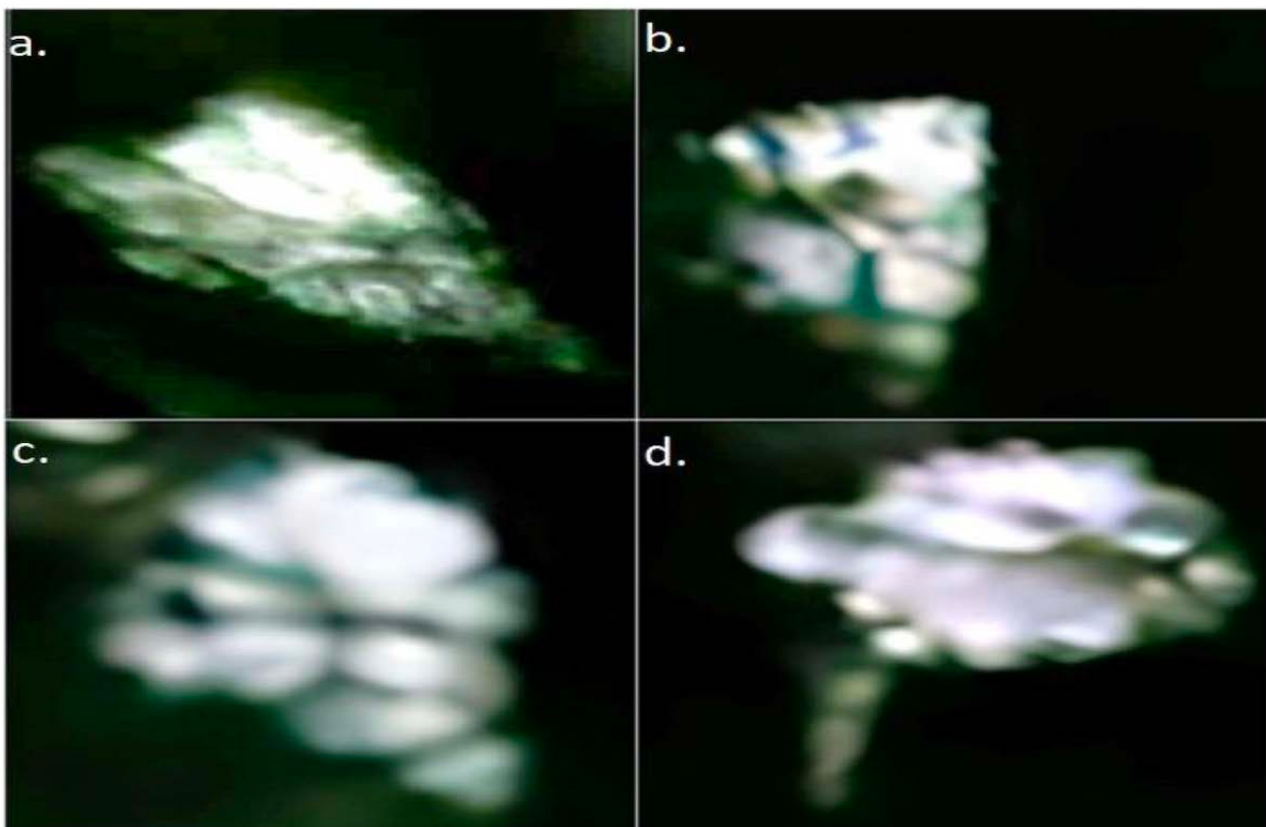


Figure 55. Examples of unusual types of plasmoid morphology: (a) Wedge-shaped with sculpted external surface, (b), (c) Wedge-shaped and composite with appearance resembling a “bunch of grapes” (botryoidal), (d) Irregular ellipse with sculpted external surface and a possible appendage or tail [112].

21.1. Methods: Morphological Analysis

21.1.1. Images

Analyses of individual plasmoids [112] were based on video footage recorded by various Space shuttle missions [3]. The original NASA film was digitized using Apple Final Cut Pro. Freeze-frame images of individual plasmoids were then processed using “Fotor” image enhancement software and one or more of these features were applied: anti-blur, and adjustment of brightness, contrast, or sharpness [1] [2]. In addition, to enhance internal features, “Fotor” red, blue, and green filters were applied as these filters can enhance spectra embedded in the original frames. This process can identify and define shapes within shapes, based on different spectra and gray values of each specimen and the “shape-spectra” of various outer and inner aspects of the specimen.

21.1.2. Analysis of Morphology

The sample of 32 images was analyzed by Armstrong *et al.* [112] using Orange data mining software (version 3.35.0) together with various *post hoc* Image Analytics, including “hierarchical clustering” (HC) and “multidimensional scaling” (MDS). Images were input as PNG files for compatibility with Orange software and then “embedded” using “Google Inception V3 deep convolutional neural network learning” which extracts 2048 column vectors from each image representing morphology, color, and texture (reviewed by Armstrong *et al.* [112]). The columns were “normalized” to ensure equal weighting of all 2048 vectors. “Distances” were then computed among the vector columns using the “cosine metric” which reflects the degree of similarity among the plasmoids.

The data were then subject to two further analyses: 1) HC (using the default “Ward” method) and which results in a dendrogram obtained from the calculated distances and essentially attempts to “classify” the plasmoids into groups and 2) MDS which displays the relationships between the plasmoids spatially in 2D or 3D, the distances between plasmoids reflecting their degree of similarity. In addition, MDS provides several further insights into the similarities among the plasmoids, first, by indicating which pairs of plasmoids exhibit affinities (by joining them with a line) and second, by the size of the round symbol representing the plasmoid, larger sizes indicating less confidence in the validity of the pairing, as the 2D display is an approximation to the multi-dimensional model [112]. Furthermore, various morphological features, e.g., shape, degree of illumination, surface texture, presence of tails, and edge detail can be plotted onto the MDS to determine which aspects of morphology were most important in determining the similarities among plasmoids.

21.2. Results: Morphological Analysis

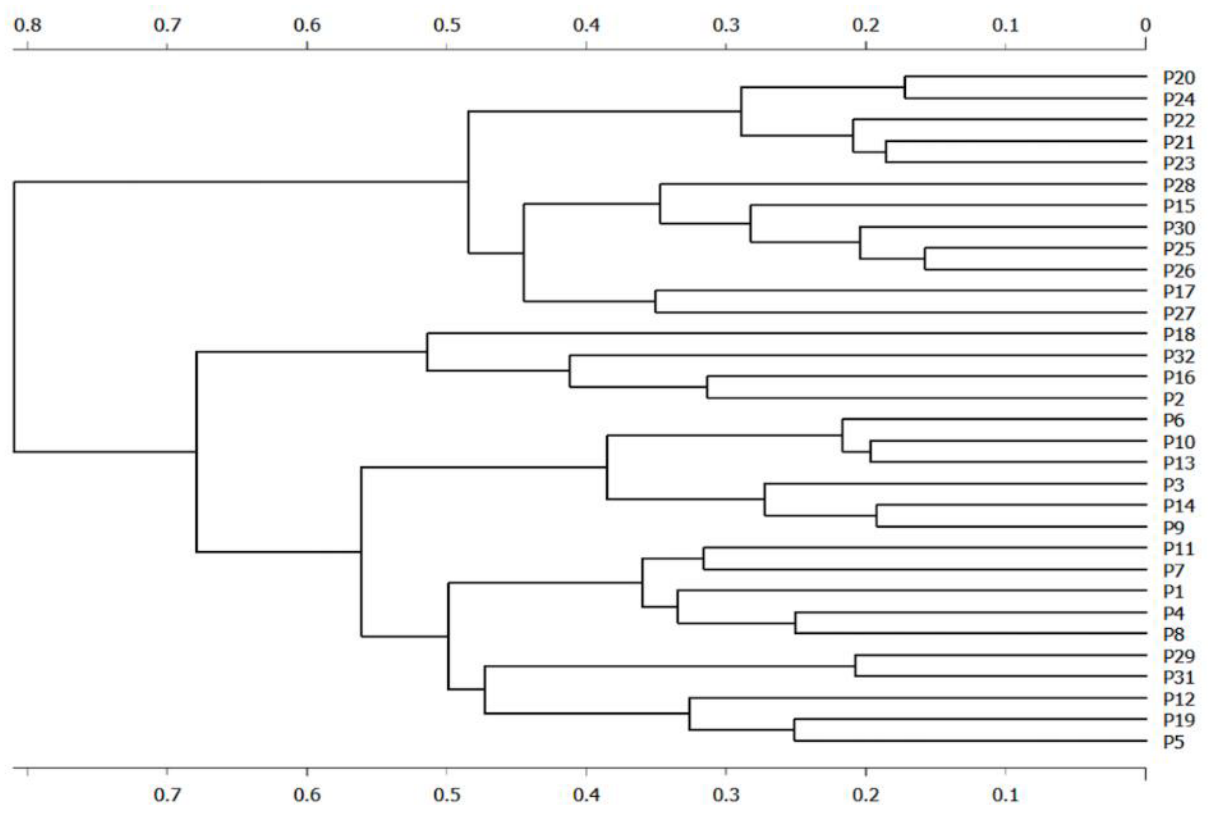


Figure 56. Hierarchical clustering (HC) of the sample of 32 plasmoids. All individual plasmoids (P1 - P32) are located to the left and are progressively joined from right to left to form a dendrogram [112].

The HC which classifies the 32 plasmoids is shown in **Figure 2(X)**. From right to left, individual plasmoids were successively combined with those that they resembled most closely and then the groups were joined so that ultimately, all plasmoids were combined into a single group. Changes in “linkage distance” as groups were successively joined moving from right to left was used to determine how many groups should be retained. As linkage distance increased, larger and larger groups were formed but result from the amalgamations of groups with a greater degree of diversity. A clear discontinuity in linkage distance indicated that many groups are being amalgamated at the same linkage distance and this level can be used as an approximate “cut-off” to determine the number of groups to retain. In the present analysis, this discontinuity occurs at a linkage distance of approximately 0.38 units and indicates the presence of seven groups of plasmoids (Groups A to G) and two individual “outliers” (P18 and P32) (**Table 10**).

Group A appeared to be the most consistent morphologically ($N = 5$), and comprised highly illuminated shapes, lacking tails, and with a complex “botryoidal” type surface. Group B ($N = 5$) was similar to group A, but 3/5 plasmoids showed evidence of a tail. The two plasmoids comprising group C (P17, P27) were more similar to group A, but lacked tails while group D ($N = 2$) did not appear to be closely related to each other or to the other groups. Group E ($N = 6$) comprised various shapes, full or partly illuminated, a botryoidal surface, and serrated edge

Table 10. Characteristics of the seven groups of plasmoids (A - G) and two outliers (P18, P32) identified by the hierarchical classification (HC), NE = Not evident.

<i>Group</i>	<i>Shape</i>	<i>Illumination</i>	<i>Internal cavity</i>	<i>Surface texture</i>	<i>"Tail"</i>	<i>Edge structure</i>
A	Various	Full	NE	Botryoidal	No	Various
B	Various	Mainly Full	P18	Botryoidal	3/5 with tail	Various
C	Various	Full	NE	Various	No	Various
D	Various	Full/Part	P2	Botryoidal	No	Various
E	Various	Full/Part	NE	Botryoidal	No	Serrated
F	Wedge	Full/Part	P7	Various	2/5 with tail	Serrated
G	Various	Full	P5,P12	Various	No	Serrated
H	Various	Full/Part	P29	Various	1/2 with tail	Various
(P18)	Ellipse	Part	NE	Botryoidal	2 tails	Smooth
(P32)	Ellipse	Part	Yes	Irregular	Long tail	Smooth

with no visible evidence of an internal cavity. Group F ($N = 5$) was largely wedge-shaped, variously illuminated, had a varied surface texture, 2/5 had tails, and a largely serrated edge. Group G ($N = 5$) comprised various shapes, two plasmoids had evidence of an internal cavity, one with a tail, a complex surface texture, and a serrated edge. Two plasmoids (P18, P28) were not closely related to any of these groups, both were elliptical and only partly illuminated, with long tails and a smooth edge.

To investigate the relationships of the plasmoids in more detail, the images were also analyzed using MDS (**Figure 3**). The MDS indicated that the 32 plasmoids were best described as forming a single large cluster within which no clear groupings were evident. Two plasmoids (P17 and P27, **Figure 4**) and a possible third (P31) appeared to be outliers with few connections to the main cluster. In addition, there were four plasmoids (P2, P16, P18, and P32, **Figure 5**) which had no connections with the main cluster or with each other.

The extent to which the seven groups identified by the HC were distinct from each other can be observed in **Figure 6**, in which the boundaries of the groups A to G are plotted onto the MDS. The most distinct grouping is group A which is also represented by consistently small-sized symbols indicating high confidence in their relative positioning. Nevertheless, the plasmoids in group A were also closely related to some individuals in groups C, B, and E, although these groups did not overlap. By contrast, plasmoids in group A were not closely related to those in groups D, F, or group G; group G appearing particularly difficult to define as it overlapped with groups E and F. **Figure 6** confirmed the status of P18 and P32 as outliers but P2 and P16 did appear to have a closer relationship with the main clusters.

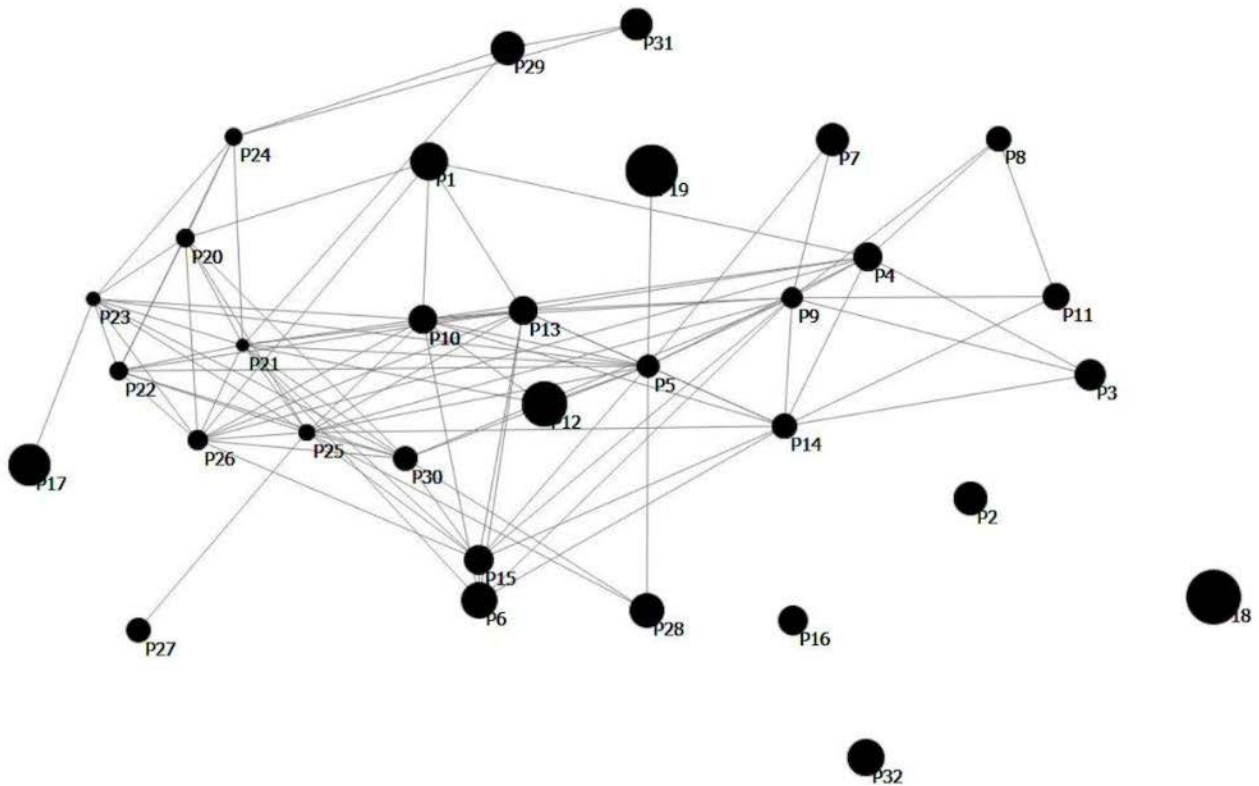


Figure 57. Multidimensional scaling (MDS) of the sample of 32 plasmoids (P1 - P32). Plasmoids with similar morphological characteristics are joined, the distance between them representing the degree of similarity. The size of the symbol representing each plasmoid indicates the degree of confidence in its location in the 2D representation [112].

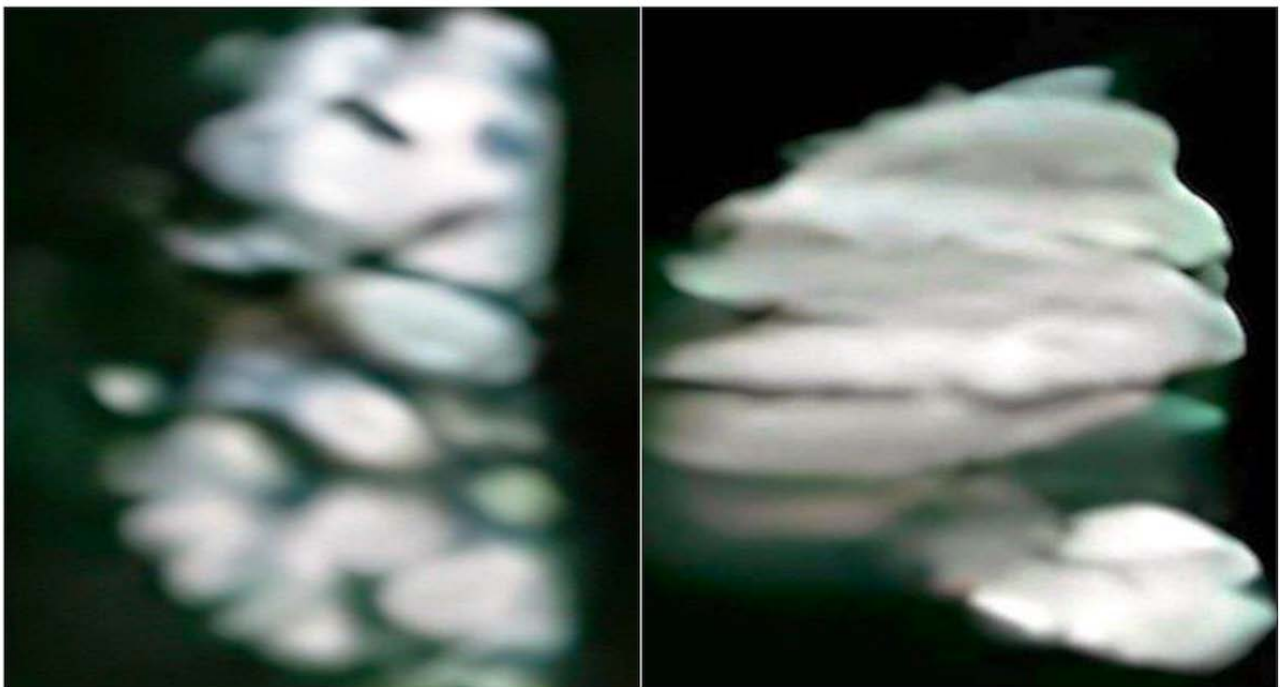


Figure 58. The two plasmoids: (a) (P17), (b) P27 identified as “outliers” to the main cluster on the MDS [112].

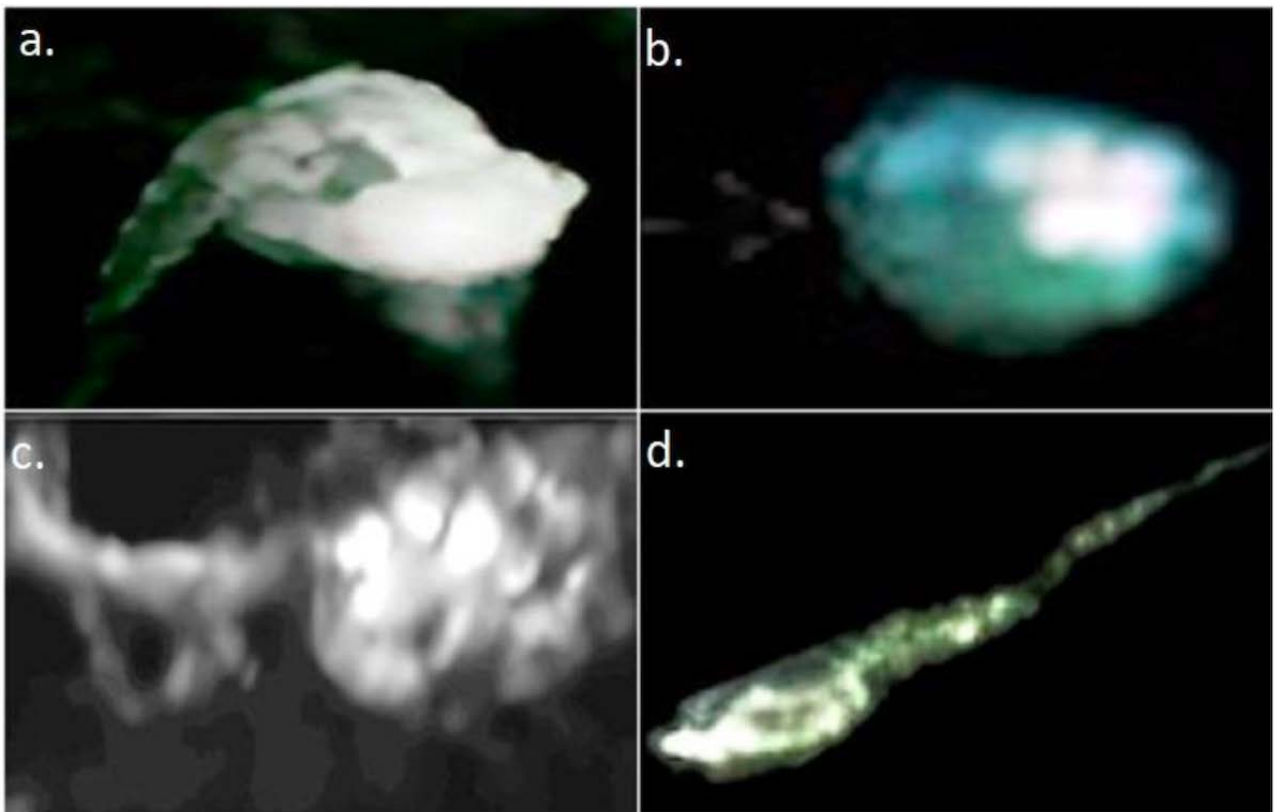


Figure 59. Four plasmoids (a) P2, (b) P6, (c) P18 and (d) P32 with no connections to the main cluster or with each other identified by the MDS [112].

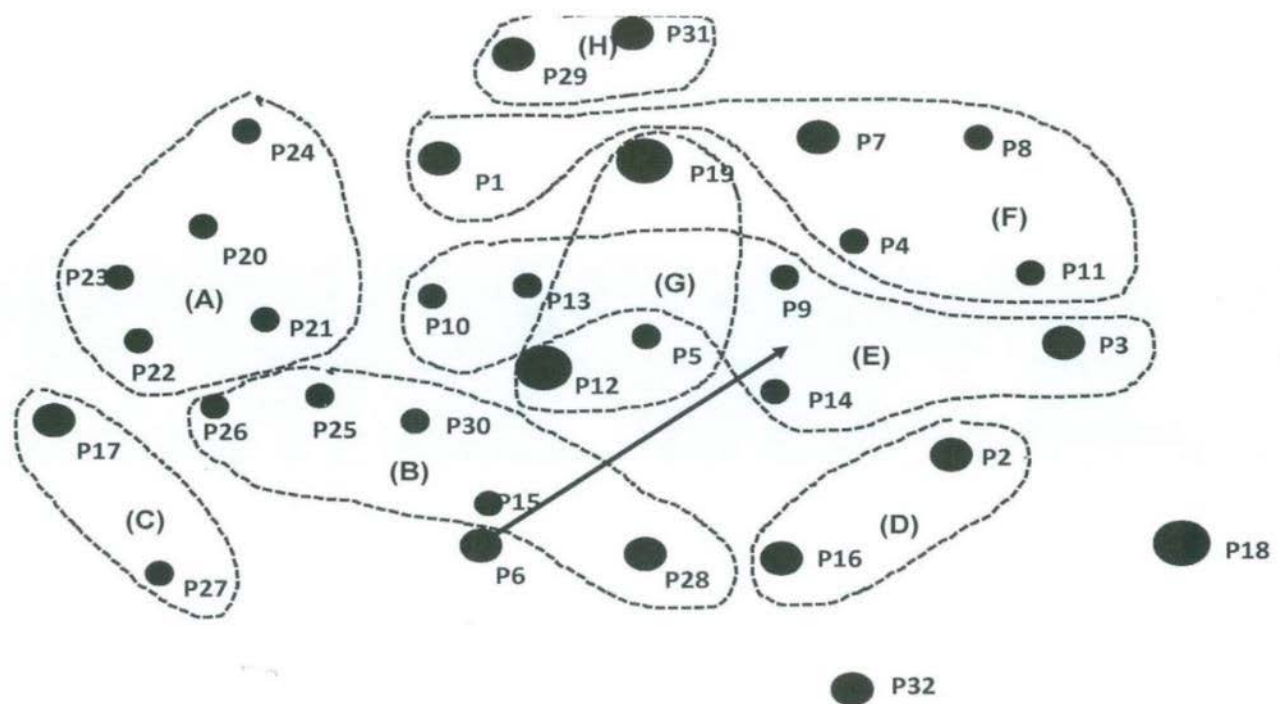


Figure 60. The seven groups (A - G) of plasmoids (P1 - P32) identified by HC plotted on MDS [112].

To determine which characteristics best explain variation in plasmoid morphology, each individual feature was plotted on the MDS. For example, plotting the various plasmoid shapes (**Figure 7**) suggested that those towards the top of the plot were more likely to be wedge-shaped. Moreover, those plasmoids with a distinct appendage or tail were more likely to be located towards the right and lower region of the cluster. By contrast, illumination, surface texture, or edge characteristics were less important in determining the distribution of the plasmoids.

21.3. Discussion: Morphology

DL clearly indicated that the sample of plasmoids was heterogenous as discussed in detail by Armstrong *et al* [112]. Although the HC successfully separated the 32 plasmoids into seven groups (A - G), the MDS indicates that apart from one relatively distinct group (group A), this heterogeneity could be best described as forming a single continuously varying cluster plus a series of “outliers” not closely related to the main cluster. Within the main cluster, plasmoid shape and whether or not an appendage or tail was present appeared to be the main determinants of the observed variation [112].

Application of image analysis to the plasmoids [112] revealed that many of them exhibited a complex morphology and appeared to be composed of multiple subunits (spherical or more complex in shape) with a proportion exhibiting an internal space or “voids” or varying shapes and sizes [1] [2]; and similar observations have been reported for plasmas created in a laboratory [73]. It was also confirmed that those referred to as Hunters display external tails that may consist of plasma and dust [1] [2].

22. Plasmoids: There Are at Least Four Behavior Types (A) Hunters (B) Grazers (C) Floaters (D) Thunderstorm Divers

Electric currents produce magnetic fields. Charge separation causes electric fields. Therefore, plasma may engage in completely different behaviors, depending on their density, and intensity of their surrounding electric currents and magnetic fields, including those generated by other plasmoids. Plasmas may be pumping electrical energy from one plasma to the next, via twisted filaments and ropes called “Birkeland currents.” Moreover, increasing or decreasing their surrounding electric currents will correspond increase or decrease in their velocity. In consequence, and relying upon the descriptions first employed by Sagan [17] and depending on their size, shape, density, and charge, some plasma in the thermosphere appear to behave as “Hunters” and others as “Grazers” (scavengers) and “Thunderstorm Divers” and those that remain relatively unmoving could be classified as “Floaters” [16].

(A) Hunters. Hunters are active, energetic, have various shapes and display at least nine types of hunting behavior which different Hunters may adopt depending on variables unknown at this time.

1. Hunters move at hyper-speeds in a relatively straight line piercing multiple Floaters and Grazers.

2. Hunters that move at hyper speeds are elongated and wiggle snake- and accordion-like as they strike and pierce multiple floaters and grazers.

3. Hunters also move relatively slowly and may be cloud or cone shaped.

4. Hunters may move relatively slowly then rapidly speed up and change direction.

5. Hunters will remain stationary for long periods, then begin moving slowly as they target and strike and pierce other plasmoids. It is possible these are Grazers that also hunt.

6. Hunters will change direction and collide with other Hunters that have also changed direction, or with Grazers that have moved into a position and then remain stable only to be pierced.

7. Hunters will eject streams of glowing clouds or particles before or after they strike.

8. Hunters may appear as dim-shadows that may or may not become illuminated.

9. Hunters may suddenly materialize and appear fully illuminated.

10. Cone-bulbous-shaped hunters may oscillate in size and illumination as they approach or pass by a Floater or a Grazer. The waxing and waning in size are directly related to propulsion.

(B) Grazers. Grazers are semi-passive plasmas and are presumed to be grazing feeding on electromagnetic energy. Grazers may have cloud, ring, or cone shapes and may be targeted by Hunters. Behaviorally there are at least four types of Grazers.

1. Grazers that move slowly and may stop and remain stationary.

2. Grazer that were stationary and then slowly moved to another location.

3. Grazers that keep moving, albeit slowly in variable changing directions.

4. Grazers may appear as dim-shadows that may or may not become illuminated.

(C) Floaters. Floaters generally have cloud shapes and are passive plasmas and are so named because they remain “relatively” stationary.

1. Floaters float alone or congregate in groups of three or more that remain relatively close together.

2. A single Floater in a group of Floaters may attract multiple Hunters which target and sequentially strike that Floater while ignoring the others.

3. Floaters in groups are sometimes interconnected via cloud-like spokes.

4. Floaters in groups—filmed near a satellite tether generating electromagnetic impulses into the space medium—also appear to be connected to cloudy networks of electromagnetic “ropes”, “cable” tubular loops that appear to have multiple mini-bud-like protrusions (**Figure 60**). These “ropes” are twisted strands of very thick plasmas.

5. It is probable that “Floaters” are outgrowths of these electromagnetic net-

works of plasmodic “ropes” and “chains” and once free of these “ropes”, these Floaters may become “Grazers.”

6. It is also possible these electromagnetic chain-ropes attract plasmas which may remain stationary only because they are drawing energy from these looping ropes; and this might explain why “Floaters” are targeted by Hunters and even Grazers; *i.e.* as a source of energy.

(D) Thunderstorm Divers. Pulsating, brightly illuminated plasmas commonly propel themselves toward and dive into lightning storms.

1. Typically they arrive singling or in pairs, from multiple directions in the thermosphere, and slowly descend into the storm without burning up.

2. Almost all oscillate with light. However, different plasmas may display different patterns and speeds of oscillation, with some brightly illuminated and glowing and others displaying and on-off illuminated only within their interior.

3. Those who arrive alone or only in pairs, may join together with others that have descended into the storms. Most likely it is these thunderstorm divers that account for many UAP/UFO sightings.

4. Thunderstorm divers not only dive but will ascend from storms, either alone, or in groups of four or more, sometimes forming V formations that will pace the space shuttles.

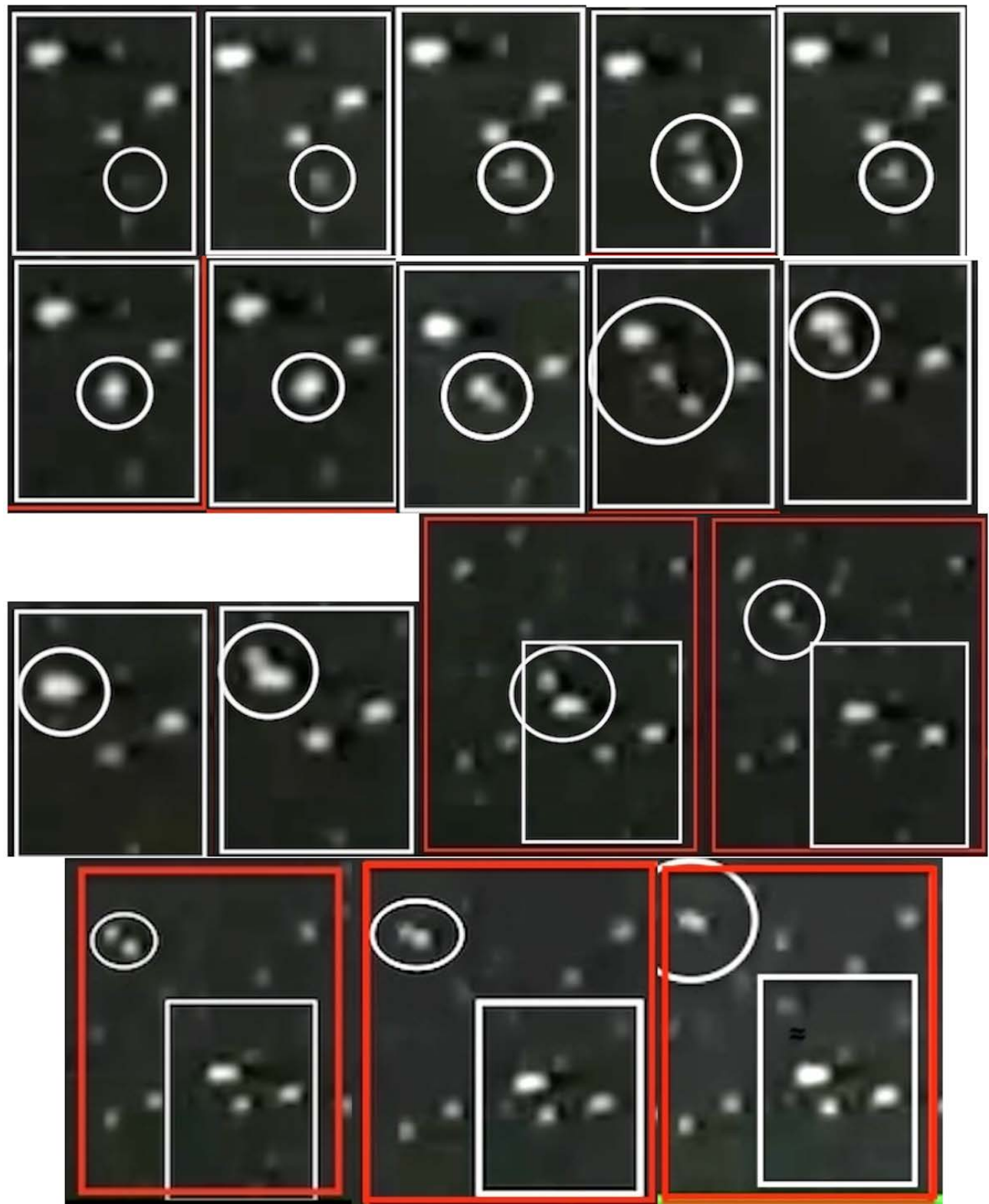


Figure 61. Hunting and collisionality. Filmed by STS 75.

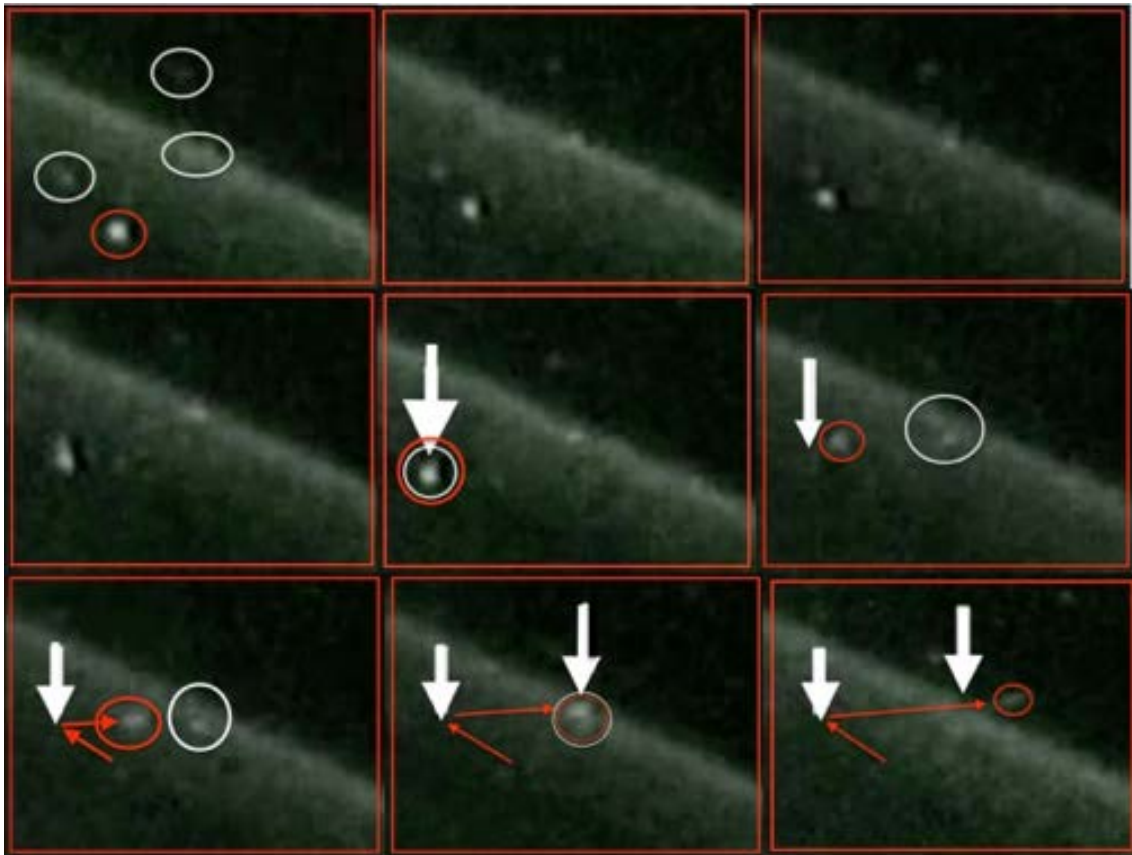


Figure 62. Filmed by STS 48. Specimen circled in red, strike first one (circled in white) then changes course by over 45 degrees to strike two additional specimens (circled in white).

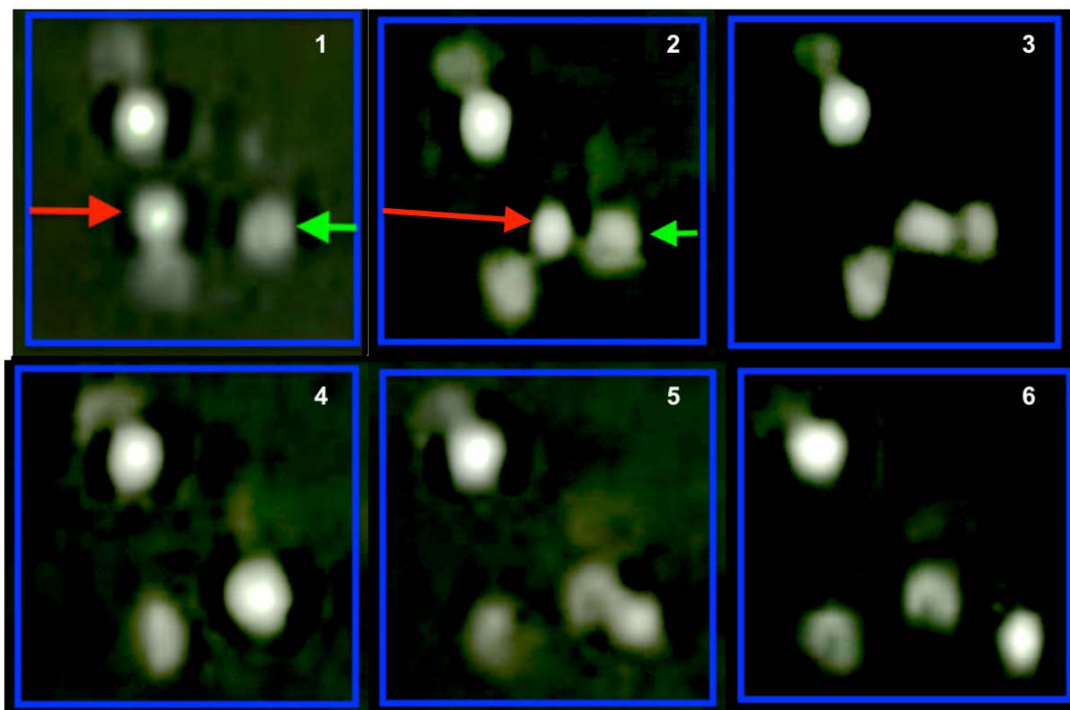


Figure 63. Filmed by STS 75. Collisionality (Energy Cannibalism?). Plasma (red arrow) alters direction after merging.

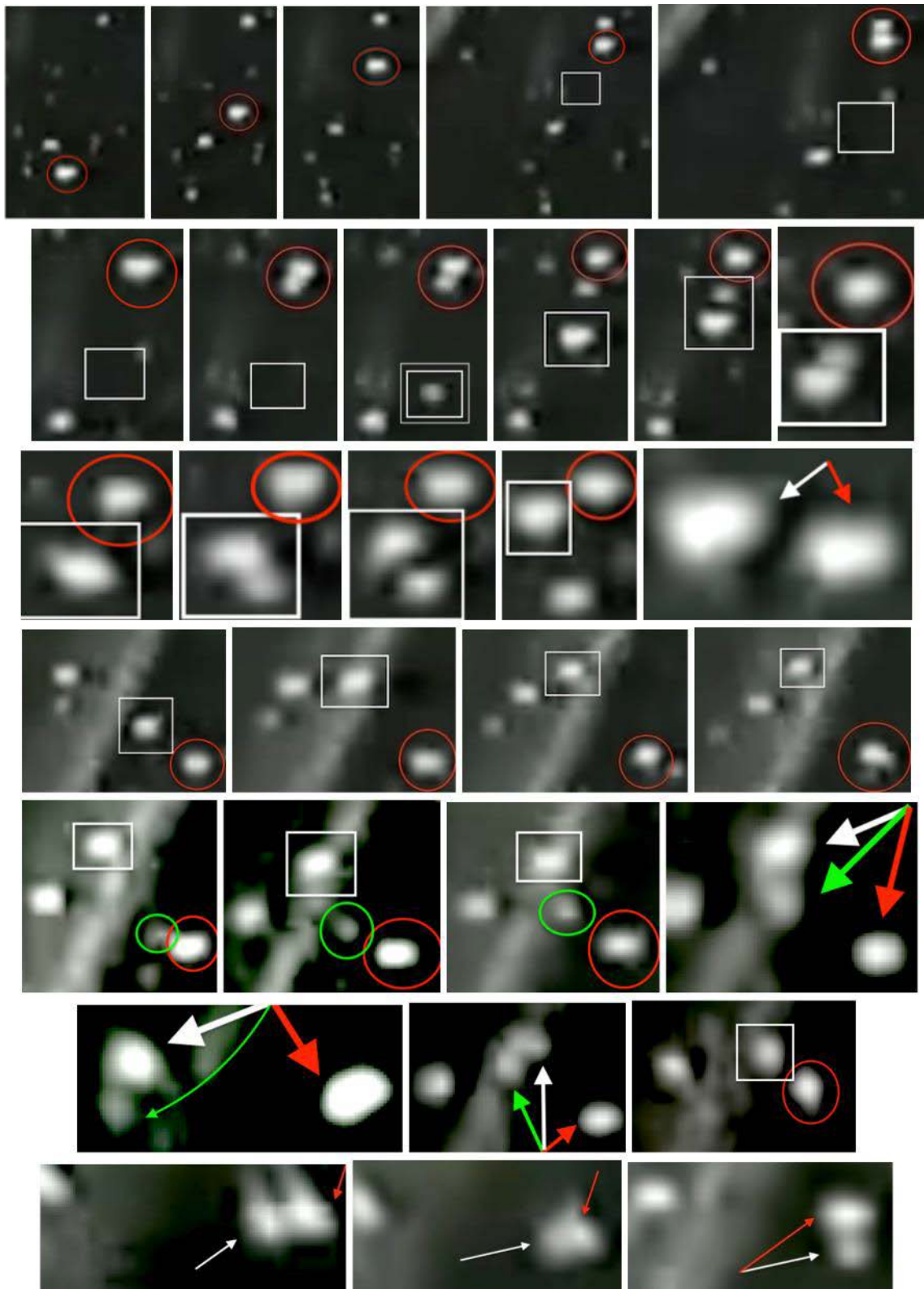


Figure 64. Filmed by STS 101. The white box plasma materialized, followed Red Circle plasma, intersecting the same plasma Red Circle penetrated. Red and White make contact and White continues toward the thunderstorm. Red Circle ejects a smaller plasma circled in green, which makes contact with White Box Plasma which reverses course, contacts White Circle Plasma. These interactions could be interpreted as communication, intelligence, social behavior.

23. Solar Plasmodic Electromagnetic Flux “Ropes” and “Cables”

Analysis of NASA space shuttle footage employing Fotor BGR filters revealed networks of “ropes”, “cables”, and “chains” completely surrounding an electrified tether (**Figures 59, Figures 60**). These are likely twisted strands of plasma with a tubular geometry as commonly detected in the magnetosphere, and which transmit electric currents from one region of the magnetosphere to another [31] [113]-[117]. The sun emits an electrically conducting plasma which streams radially outward at supersonic speeds of about 500 km/s into interplanetary space thereby producing a solar wind which consists of electrons, protons, and ions, including Helium ions all of which becomes increasingly dilute as the plasma wind expands radially and with increased distance from the sun [113]-[118].

This outflow of plasma is the result of the supersonic expansion of the solar corona and consists of high-temperature fast particles, electrons and ions which reach velocities ranging from 300 km/s and 1500 km/s thereby enabling this ejecta to overcome solar gravitation and escape into interplanetary space [113]-[118]. However, even as it flows through space, this plasmodic wind remains electrically highly conducting, acting as a superconductor and forms an interplanetary magnetic field. Once the solar wind traveling at supersonic speed hits Earth’s dipole magnetic field, it is deflected and slowed down and a *bow shock* wave is generated in front of Earth. In consequence, a substantial fraction of the solar wind particles’ kinetic energy is converted into thermal energy whereas the remainder continues to serve as a highly conducting plasma consisting mainly of electrons, protons, ions, and highly charged particles and dust and debris [14]-[15] [113]-[118].

These highly charged plasmas are distributed in a variety of directions and can form interlinked networks of plasmodic rope-chain-cables that generate electric currents and electromagnetic fields from which globular, cellular plasmas may form and bulge outward. In **Figure 59**, the topography of the solar-terrestrial-atmospheric environment can be discerned, with the sun located to the far lower right of the tether. The solar wind is therefore blowing against the terrestrial-upper atmospheric (geomagnetic) field. Although fragmented cables are apparent in almost all quadrants of this film footage as depicted in published freeze frames, those closest to the tether, are coiled together forming interconnected networks of looping cables (**Figure 59 & Figure 60**). This suggests that tether is amplifying the charge of the plasma flux ropes.

24. Ionization, Electric Fields and Plasmoid Origins

It is believed that plasmas in space and the thermosphere react to and may form cellular entities in response to a number of interacting forces, including intermittent turbulence, geomagnetic storms, coronal mass ejections, solar flares, eclipses, the waxing and waning of sunlight, and atmospheric waves coupled with ionization [1] [13] [119] [120]. When ionized, the result is a plasma.

As predicted by Maxwell’s equations and as has been since confirmed, electric

fields and powerful stellar magnetic fields are abundant in space [31] [97] [121]-[124] Likewise, cosmic rays are electrically charged. Planets, including Earth also have global electric fields which affect the upper atmosphere as determined by NASA's Endurance mission [125]. Thus, the upper atmosphere and the space around Earth are filled with electrons, protons, and energy created by interactions between the Earth's magnetic field, solar wind, and cosmic rays—as well as dust and debris from shattered meteorites—all of which contribute to the creation and behavior of double layered plasmoids in the thermosphere.

Specifically, as charged particles enter Earth's upper atmosphere and strip away electrons from atoms, the remaining protons, neutrons and particles become ionized with a net positive charge which repel, whereas those electrons that have been stripped away have a negative charge and form negative ions; all of which respond to electrical and magnetic fields thereby forming negative and positive double layers that simultaneously repel and attract yet preventing the layers from merging [8]-[9] [11]-[12] [31]. Thus, plasma in the thermosphere become encapsulated with cellular layers. When dust, cosmic debris, and shattered remnants of meteorites are incorporated within a plasma, and if charged, they may trigger the creation of encapsulating double layers and the composite is referred to as a “dusty plasma” [1] [69].

In addition, positive ions, which are the major constituent of the solar wind, accelerate outward from the sun and form plasma filaments, ropes, cables and tubes [14] [15] [69] [126]-[129]. The spacecraft Ulysses, for example, discovered long plasma tubes (Birkeland currents) extending from the south pole of the sun as far out as Mars.

25. Electromagnetic Networks of Flux “Ropes” and “Cables” Discovered in the Thermosphere?

Electric currents commonly form twisting plasma filaments; e.g., in lightning, the penumbrae of sunspots, and the sun's photosphere and looping prominences. Galactic and solar electromagnetic impulses coupled with Earth's magnetic field and plasmasphere also interact and produce auroras and donut shaped magnetic filaments that twist, curve, loop and spiral together forming double layered ropes and cables of plasma tubes [9] [10] [31] [113] [114] [126] [129] [130].

These plasmodic circuits of magnetic flux rope-chains are prevalent throughout the upper atmosphere but usually require specialized optical equipment to detect them. This is because these plasma-rope-chain-cables only become “visible” in highly energized environments, such as above the sun and in the upper atmosphere, where they appear as multi-colored sheets, filaments, and clouds of plasma, *i.e.* auroras [10] [11] [31] [126] [127] [130].

Long filaments, cables and ropes of magnetized plasma are also produced by electric current which tend to follow magnetic fields. An electric current is caused by high voltage which creates an electric field (Pratt, 1992). The stronger the current the stronger the electric field. A strong looping current will produce donut

shaped magnetic fields and filaments [10] [11] [31] [121]-[124]. These filaments have been characterized as magnetic flux tubes and cables which form tangled loops.

The formation of filaments, strings, cables, ropes are common throughout the cosmos and form endless circles and spirals: an infinite helix—all referred to as “field aligned currents.” The size of the spiral helix is determined by the strength of the magnetic field—as strength increases and the spiral will tighten forming chains as can be visualized in **Figure 56**, **Figure 60**.

Portions of the chains may begin to assume cellular forms as they bulge out and “break off” (**Figure 57**, **Figure 58**). Once a double layered “dusty” plasma is formed, they and the dust and debris internalized, may continue to spiral forming an internal helix. This may also cause positively and negatively charged particles and debris to diffuse together, creating bright illuminated arc discharges; also known as ambipolar diffusion. When these particles interact—including and especially those within the plasma layers, they generate electric fields which affect their motion.

These electromagnetic rope-chains typically have a tubular geometry and have been produced in the laboratory and observed in a variety of astrophysical settings [10]-[12] [31] [81] [82] [97] [115]-[118] [122]. The most active areas of the sun, for example, produce flux ropes that not uncommonly form chains and loops (**Figure 54**).

These magnetic twisting ropes flow with the solar wind—a function of interactions with the magnetic fields and magnetic clouds produced by coronal mass ejections and are affected by the south-then-north tilt of the magnetic field [31] [115] [116]. In the upper atmosphere of Earth, these rope-chains also interact with charged particles, leading to phenomena like filmy-cloudy auroras, which are in fact twisted strands of plasmas that resemble sheets and filaments of ghostly wavy light [126] [127] [130]. These rope-cable-chains, therefore, are electromagnetic plasmas that produce additional plasmas that can take a variety of shapes and forms, e.g. auroras.

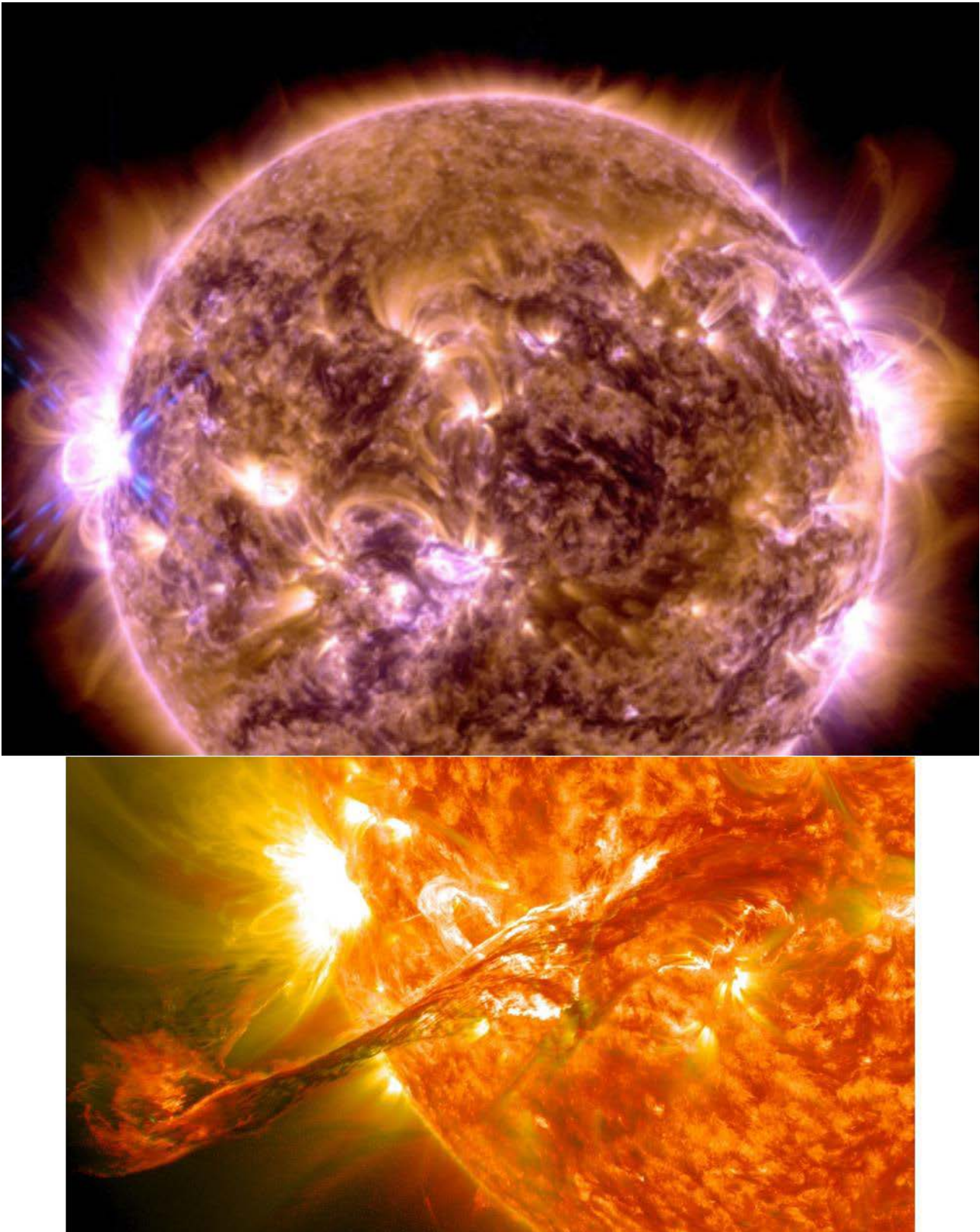


Figure 65. The Sun. Solar flares. Photos by NASA.

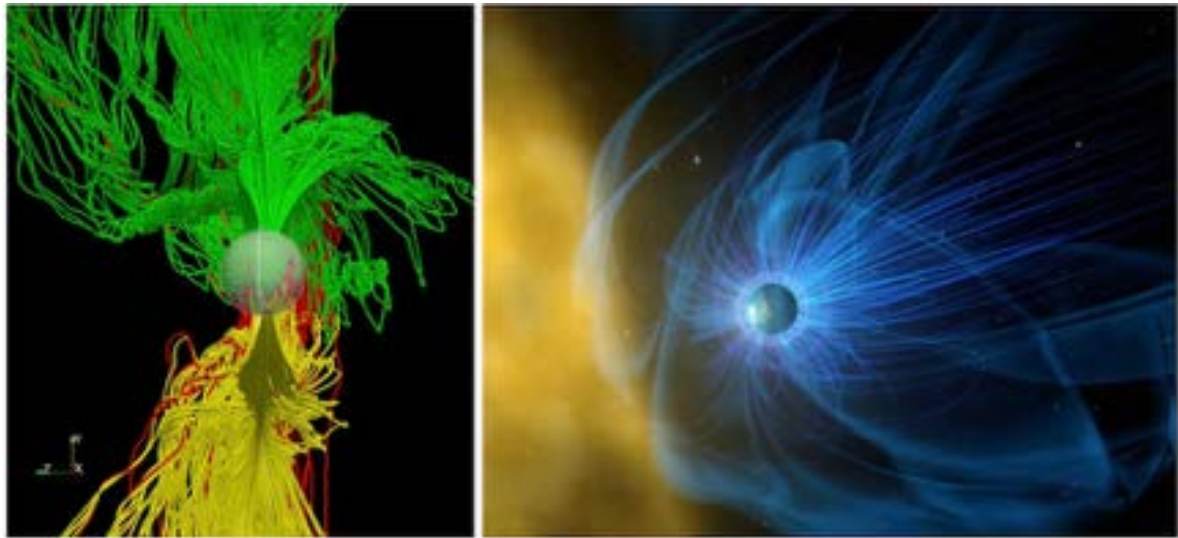


Figure 66. (Left) Simulation of giant storms of plasma flux ropes and magnetic fields propelled from the southern and northern poles of the sun. Credit: NASA, Homa Karimabadi, University of California, San Diego. (Right) Plasma flux ropes and Earth's plasmasphere/magnetosphere.

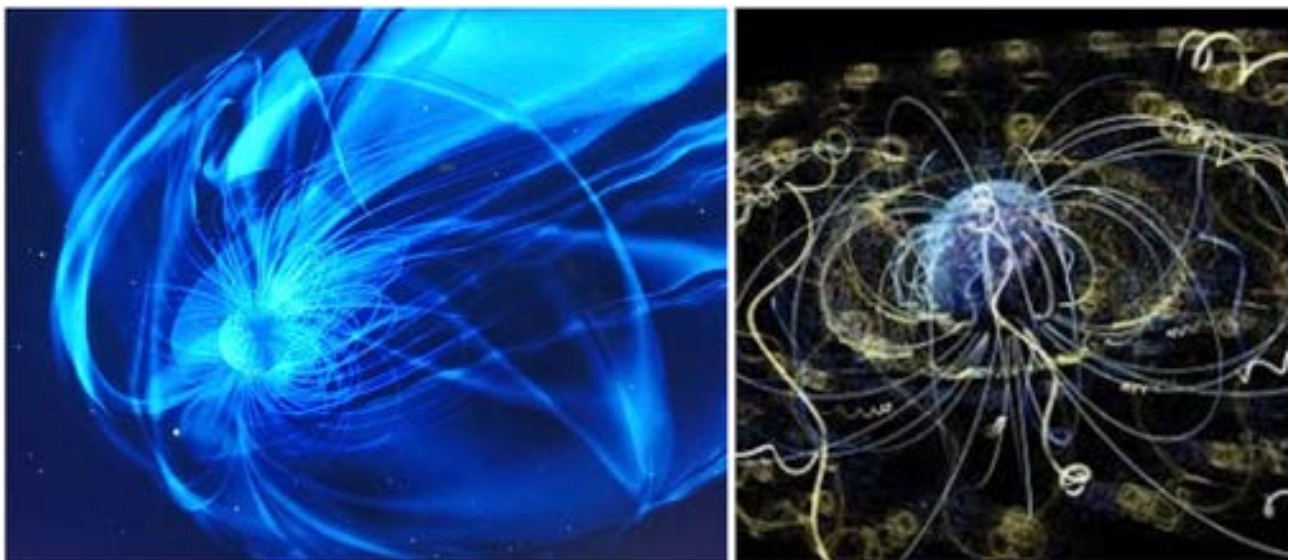


Figure 67. Simulations of plasma electromagnetic flux ropes and cables enveloping and entering the “hole” in Earth's northern polar magnetic field and forming loops, spirals, and helixes. Credit NASA.

26. Some Plasmoids Are Formed by or Obtain Energy from Networks of Electromagnetic Flux “Cables”?

One of the goals of the STS 75 shuttle mission was to release a satellite tether, 12 miles in length, that generated electromagnetic impulses into the surrounding space medium. After 19 of 24 kilometers of conducting tether was released, and producing 400 volts of an expected 7000 volts, plasmas began flowing toward the tether and there was a powerful electrical discharge that burned through the tether which continued to generate electromagnetic activity. Over the course of the next 12 hours, dozens, then hundreds of self-illuminated “plasmas” began appearing

next to and streaming toward and even making contact with and appearing to crawl upon the tether [3] [5]. Many of these plasmoids were highly energetic and engaged in a frenzy of activity (e.g. Hunters). Others were less active (Grazers/Scavengers) with some (Floaters) remaining relatively stationary.

To detect differences in gray scales and identify boundaries, shapes and forms, Fotor BRG filters were employed to analyze tether-incident STS 75 freeze frames, and especially those regions of the densest plasmoid activity around the TSS-IR. The Fotor BGR filters revealed thick coiling networks of what can best be described as magnetic plasma “ropes” “cables” and “chains” (Figure 57, Figure 59, Figure 60). These magnetic ropes and chains are commonly detected via specialized instruments and cameras in the magnetosphere and other regions of space and consist of twisted strands of plasma that coil and group together due to magnetic attraction [10] [115] [131]-[135]. However, they have never before been visualized in the thermosphere. Therefore, we can only speculate based on very limited data. In this regard it is reasonable to hypothesize that these “rope” “cables” were made visible due to absorption of electromagnetic pulses generated into space by the TSS-IR. Some plasmoids (Floaters) appear to be attached to and may have been produced by these magnetic “rope” “cables” which also have smaller protrusions or “buds” (Figure 60).

In the context of the “tether incident” the Fotor filters revealed that plasmas identified as “Floaters” appear to be attached to these magnetic rope chains which also have numerous bud-like protrusions (Figure 60). According to Alfven [9]-[12] plasmas are often embedded in these rope cables.

It has been documented that electric current flow in space, forming filaments whereas plasma cells form around regions of filaments. Therefore, it is reasonable to suspect that “Floaters” are attached to and may be outgrowths of these thermosphere electromagnetic rope-chains. Or, conversely, that independent plasmoids will attach to these rope chains which provide energy. This may also explain why some “Hunters” will target specific “Floaters” which may be pierced by at least 4 different Hunters in less than 20 seconds; *i.e.* like bees drawn to a flower in bloom. That is, those “Floaters” still attached to these plasmodic electromagnetic ropes may be providing an additional source of energy to Hunters which seek them out.

Speculation is also probable that Floaters may later detach from these rope cables and become “Grazers” or even “Hunters.” Most likely vast plasma rope-cable networks are prevalent throughout the upper atmosphere and may be continually giving birth to the plasmoids.

Plasmas obey the laws of electromagnetism. Electrostatic pressures and extreme electrical stress cause excessive current densities on their surfaces. Although internal electrostatic forces prevent these plasma ropes and cables from collapsing, the layers of these plasma tubes may begin to pinch together, causing them to split off and form additional plasmas. Depending on their density and intensity of charge, these newly fashioned plasma may remain in a dark mode or become illuminated.

In addition, these newly formed “independent” cellular plasmas may remain

relatively stationary, or move about slowly, or engage in a frenzy of behavior and engage in collisionality and energy cannibalism [1]. Therefore, to speculate, these putative magnetic ropes, cables, strings, tubes, may sprout additional plasmas which, in response to electromagnetic pressures, bulge outward and form and pinch off multi-layered cellular structures (Figure 57).



Figure 68. Simulations of plasma electromagnetic flux ropes and cables forming loops, spirals, and helices and cellular walls within the thermosphere.

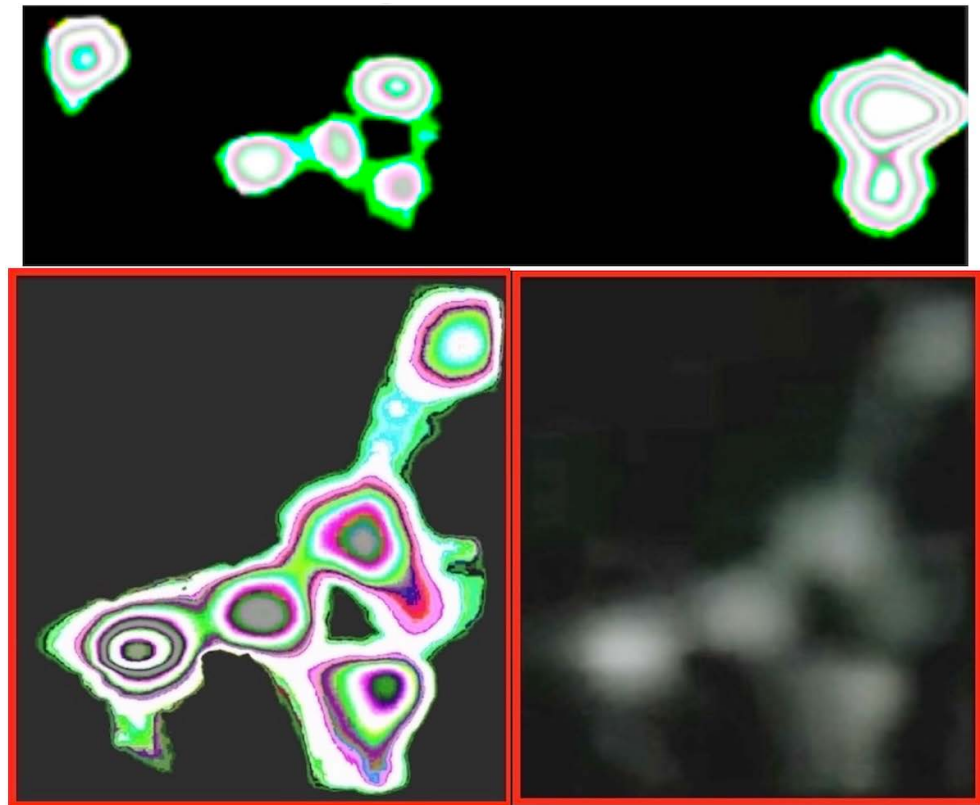


Figure 69. Plasmas in the thermosphere congregate and form interlinking plasmas. Note multi-layers and nucleus. Processed with Fotor Blue, Green, Red Filters that identify grey scales. Filmed by STS 80.

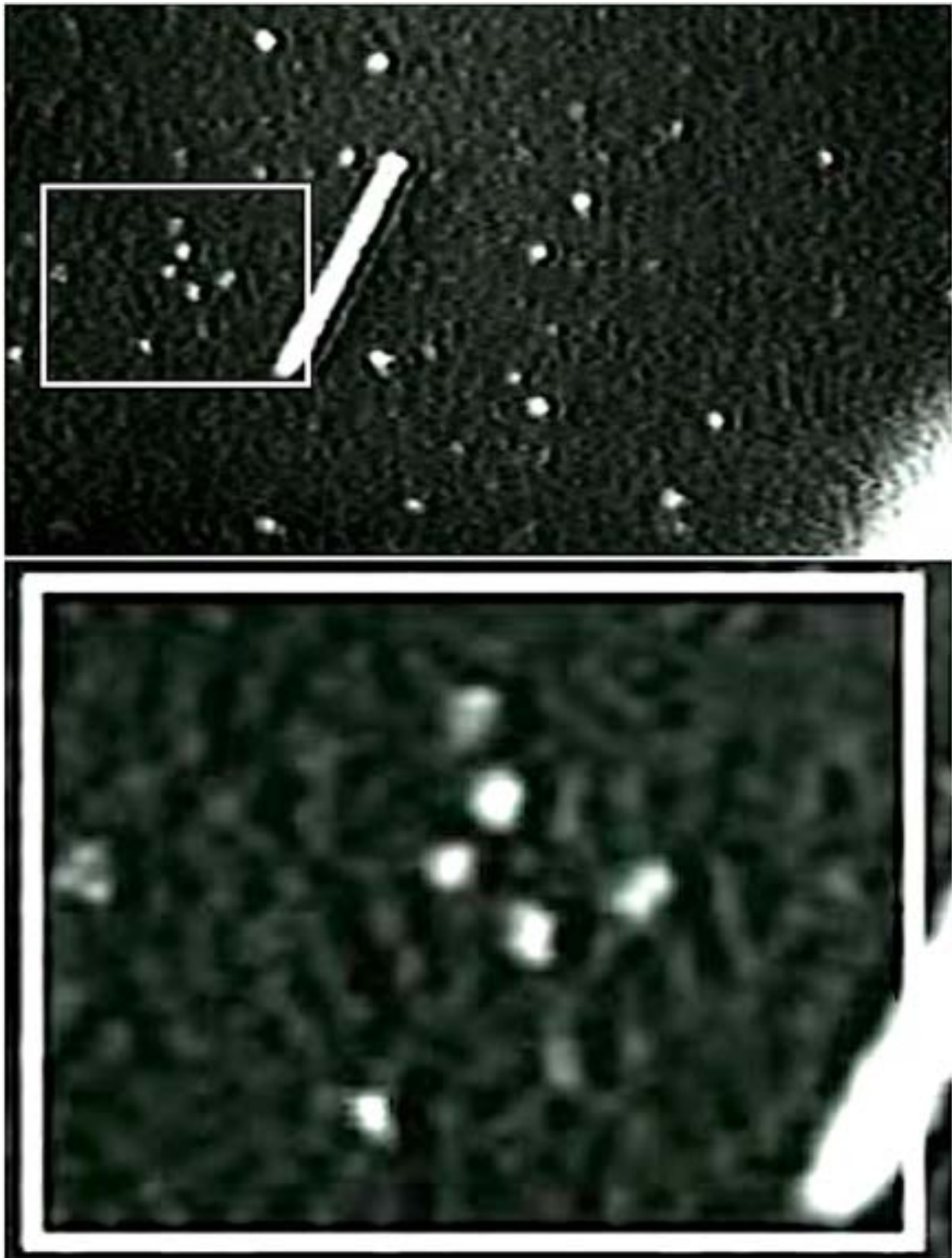


Figure 70. STS 75. A 12 miles in length tether generating electromagnetic pulses into the space medium, surrounded by plasmoids engaging in complex behavior. Note what resembles curved strands of “rope” in the background. These are most likely plasmatic magnetic flux “ropes” and “cables” which have become highly charged due to the electromagnetic radiation from the tether.

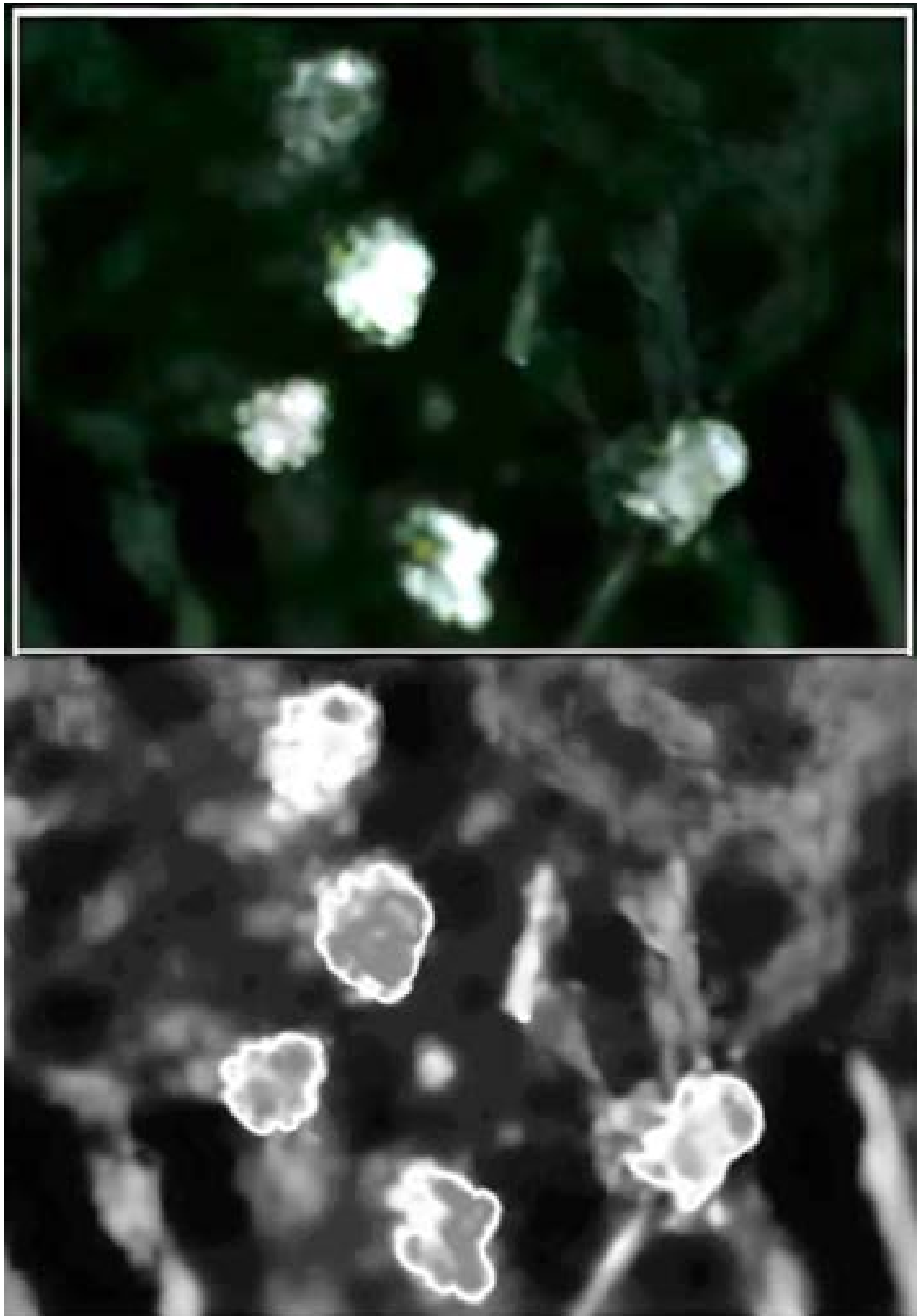


Figure 71. This Figure is a magnification of the white square area of **Figure 16**. Shape shifting plasmas often appear to consist of multiple mini-plasma, and in some films and photographs, shadowy shape shifting plasmodic forms can be discerned (entity at the top). Note the elongated darker thick-rope-cable-like forms several of which have numerous “buds” and plasmoids attached. These can also be discerned in **Figure 16** most of which are curved and form looping networks. Processed via Fotor BGR filters to detect and emphasize differences in pixilated grey scales. These magnetic plasmodic flux “ropes” may have become highly charged by the electrified tether thereby making them visible.

27. Plasmodic Brains? Solar Plasmodic Electromagnetic “Virtual Neural Networks”?

Patterns found in nature repeat themselves to infinity and can give rise to symmetry; that is, patterned self-similarity. In physics and math, the repetition of patterns is true of time, space, scaling, rotation, and functional transformations [24] [25] [136] [137] as well as neural networks, dendritic trees, and the functioning of the brain [19] [20]. If the plasma ropes in the thermosphere also function like neural networks, and if the same patterns repeat within the interior of a plasmoid, then, those networks might provide the foundation for intelligent behavior.

Plasma in the thermosphere will congregate above thunderstorms and descend into the lower atmosphere. This behavior may account for many of the sightings of what are now referred to as UAP/UFO but which have also been called “Foo Fighters” and by a legion of other names over the centuries [1] [2] [138]. According to Navy pilots and personnel these entities were aware they were under observation and engaged in purposeful “intelligent” behavior [1] [40]-[41] [139]. Based on this evidence and eyewitness accounts these complex, communicative and interactive behaviors appear directed and purposeful and under “intelligent control” [1] [2]. It is therefore reasonable to hypothesize that some plasmas/plasmoids—especially Hunters and those that descend into the lower atmosphere—are “sentient” “aware” display “intelligence” and constitute a fourth domain of life that dwells primarily in the upper atmospheres of Earth.

It has also been documented that plasmoids in the thermosphere (and those generated experimentally) contain internal glowing spheres that are not uncommonly associated with radiating arcs that connect these spheres to the outer membrane layers or to other adjacent internal spheres. It has been speculated that these could be construed as plasmoid genomes or neural ganglia connected to nerve nets [2], *i.e.* neural networks, similar to the nervous system of planarians, the common earthworm, and insects (Figure 15).

As pointed out by Langmuir [6]-[8] and Alfven [10]-[12] plasmoid double layers are electric and can transmit and exchange energy from one layer to another or to and from the nucleus thereby forming circuits or networks of excitation that include gaseous electrical discharges. According to Alfven [10]-[12] and Langmuir [6]-[8] when highly excited, double layered plasmas will discharge gases and electrical impulses-attributes that are common among plasmas in the thermosphere and the sun [14] [15] [31] [115] [118] [126] [127], *e.g.*, solar flares, coronal discharges, magnetic substorms (Figures 54-56). It is well established that plasmas (Hunters) in the thermosphere commonly discharge cloudy streams of plasma in their wake as they approach other plasmas, and during and after they have made contact: reminiscent of the release of chemicals at neuronal-axon-dendrite synaptic junctions.

These plasmodic interactions could also be considered analogous to the activity of neurons which, when highly excited, will generate an electromagnetic action potential down the length of an axon. The excited axon will then release chemicals

or electrical impulses into a synaptic gap that adjoins the dendrites of other neurons. These action potential electromagnetic nerve impulses can also be likened to a plasma. It is these interactions and interconnections between the axons and dendrites of neurons in various regions of the neocortex which provide the substrate for perceptual experience and various aspects of consciousness [140]-[155].

These putative electromagnetic-rope-cable networks discovered in the the thermosphere, in some respects, resemble and may also function in a manner somewhat similar to the “neural circuitry” of the brain which also generates electromagnetic fields (Figure 61-63).

The human nervous system consists of around 80 billion neurons which, when excited, transmit electrified “action potentials” down the length of their axon to a synaptic gap junction. Electricity and/or clouds of chemical neurotransmitters are then released into the gap junction, exciting dendritic receptors that lead to yet another neuron which may transmit the information received to yet another neuron or a host of neurons, via actions potentials propagated along the length of its axons (Figure 61). These neural circuits-vast bundles of insulated cables-enable different brain areas to communicate and share information and contribute to the experience of conscious-awareness [140]-[155]. Consider also that dusty upper atmospheric plasmoids have likely incorporated not only all the ingredients for fashioning RNA and DNA, but innumerable bacteria, algae, fungi, lichens, plants, insects, fish-eggs—and other organisms and their DNA—lofted into the thermosphere. Insect and fish-egg DNA codes for a nervous system.

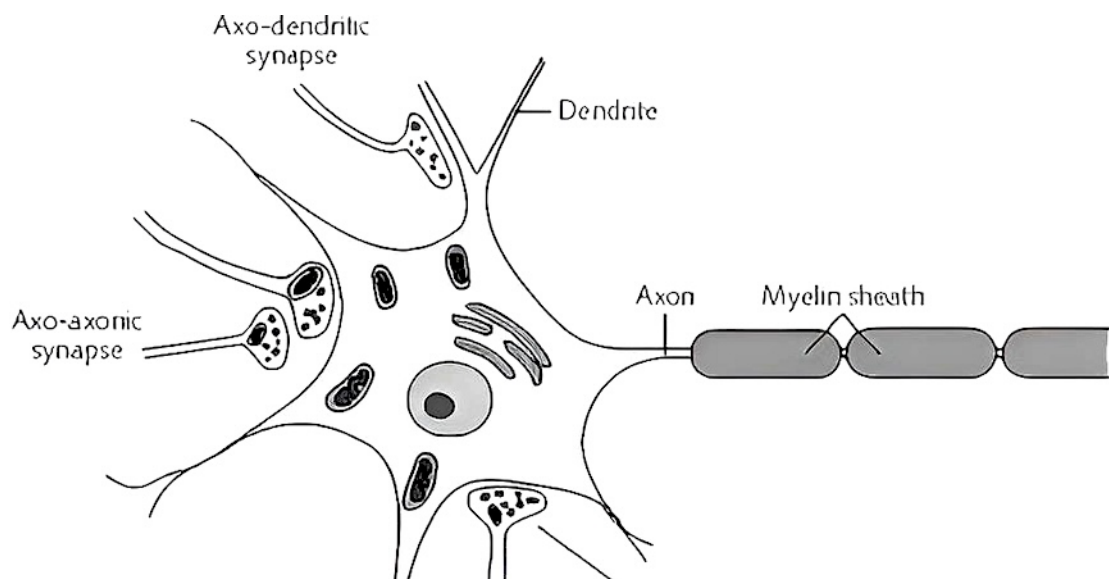


Figure 72. Neuron (Nerve cell).

As noted: Navy pilots have claimed that UAPS (which are most likely plasmas) behave with intelligence and have awareness of their surroundings. Therefore, to speculate: these networks of plasmoid-rope-chains and the internal ganglia-spheres identified within plasmas may also function like neural networks and gen-

erate and provide an electromagnetic substrate for plasmodic awareness.

Many scientists agree: plasma is a fourth state of matter, the highest energy state of matter, and much of the universe, perhaps up to 99.8% consists of plasma [10]-[12] [14] [15] [31] [97]-[99] [156]. There is also a direct association between the functioning of the brain and plasma physics [157]-[159] and the production of electromagnetic waves with estimated frequencies of 0.5 to 100 Hz and with an amplitude of 110 to 4 μ V [160]. The neurons of the brain interact via electrical impulses-the action potential—which often involve the release of various neurotransmitters at synaptic junctions; *i.e.* from an axon to dendrite [148]-[150] [155] [161].

However, whereas plasma is a form of matter, electricity is not considered to be a “state of matter” but pure energy released by the flow of electrons: an electromagnetic property shared with neurons and lightning which is a plasma that generates transient plasmas, and which attracts plasmoids in the thermosphere that gather above and descend into thunderstorms; whereas the brain radiates electromagnetic waves [160] and shares functional characteristics with plasma physics [157]-[160] and plasma-lightning share basic functional principles with nerve cell activity [159].

28. Electricity, Lightning and Nerve Cell Conduction

That electricity and nerve cell conduction are directly related may have been first documented by Luigi Galvani, who in 1780, wired a frog to a metal railing and when lightning struck observed wild twitching of the frog’s legs. In 1803 by Giovanni Aldini used a battery-powered pair of conducting rods to shock various parts of the body of a recently executed criminal, George Forster. Foster’s arms flew up, his hands clenched, and his eyes and mouth opened and closed. Thus, the direct connection between electricity and neural activity was established hundreds of years ago [59]-[61].

Electricity and lightning in fact shares analogous features with the action potential that travels from the neuron down the length of the axon. In brief: different areas of the brain are linked together and communicate via neurons which send an electrical signal—an action potential—from the neuron’s cell body down the length of an appendage, an axon. This electrical impulse travels to a synaptic gap junction and then excites a dendritic appendage of the receiving neuron. The action potential is an electrical impulse and travels down the axon as positively charged ions flow across the neuron’s axonal membrane. Electrical impulses, therefore, serve as the primary means of communication between neurons and are triggered when the neuron’s membrane potential reaches around -50 mV thereby triggering a positive charge down the length of the axon. These positive electrical charges could be likened to a lightning bolt and thus, plasma.

As determined by Persinger [159]: “The space-time characteristics of the axonal action potential are remarkably similar to the scaled equivalents of lightning. The energy and current densities from these transients within their respective volumes

or cross-sectional areas are the same order of magnitude. Length–velocity ratios and temporal durations are nearly identical... The wave shape characteristics of action potentials and lightning flashes are similar.” Persinger [159] also argues that “all of the fundamental frequencies and patterns of EEG activity are similar to local electric field configurations” during thunder-storms and Schumann (earth–ionospheric) resonances which are produced by lightning.

Consider this analogy: it is well established that dendrites are covered with dendritic spines which also receive axonal impulses. If repeatedly activated, they also grow in size, whereas if deprived of input, the dendrite and axon will shrink and become non-functional [140]-[143] [161] Likewise, the electromagnetic plasmoid chain-rope-cables in the thermosphere are also punctuated with bulbous spines that may grow and produce, or conversely, attract “Floaters.” It is noteworthy that Nitric oxide diffuses freely across neural membranes during neurotransmission and is produced in neurons in response to action potential-dependent release of glutamate [155]. However, about 25% of NO within the biosphere is formed by lightning discharges [162]. Lighting and electricity have also been considered essential for the creation of all the necessary elements and nucleotides to create a living organism [63]-[65].

Lightning, electromagnetic activity, are linked to the origins of life and nerve cell conduction. This leads us back to self-illuminating plasmas which are electromagnetic entities that are associated with plasmodic rope networks that are charged and which interact via the release of electrically charged clouds of plasma and dust particles. Plasmas give off light, and it is well established that neural activity can be altered or suppressed by light introduced via optic micro-fibers [163]-[165]. Light is not a plasma, but a form of energy; i.e. electromagnetic radiation that travels as waves and is made up of particles called photons. However, all light is produced by plasma, the sun being a primary source of light in this solar system.

The brain is a plasmodic electromagnetic organ which is affected by light and whose action potentials from axons to dendrites share features common to plasma-lightning [157]-[159] [163]-[165]. It is also these neurons, axons, and dendrites and their associated electromagnetic activity which link and “entangle” the brain to the electromagnetic quantum continuum [166]-[170] which, some believe, is consciousness in its totality [171] [172].

Plasmas are electromagnetic entities and may possess a virtual plasma-based nervous system that is not “physical” or “hard wired” but electromagnetic and whose nerve network and circuitry is electric but may have incorporated charged particles, dust, and debris, thereby creating stable interconnected electric circuits and ganglia that function in a manner similar to the eukaryotic nervous system; and which provides the foundation for intelligence and purposeful behavior.

However, a nervous system is not a prerequisite for life; and even plants—which are devoid of axons, dendrites and neurons—display behavior and an awareness of their environment [173] [174].

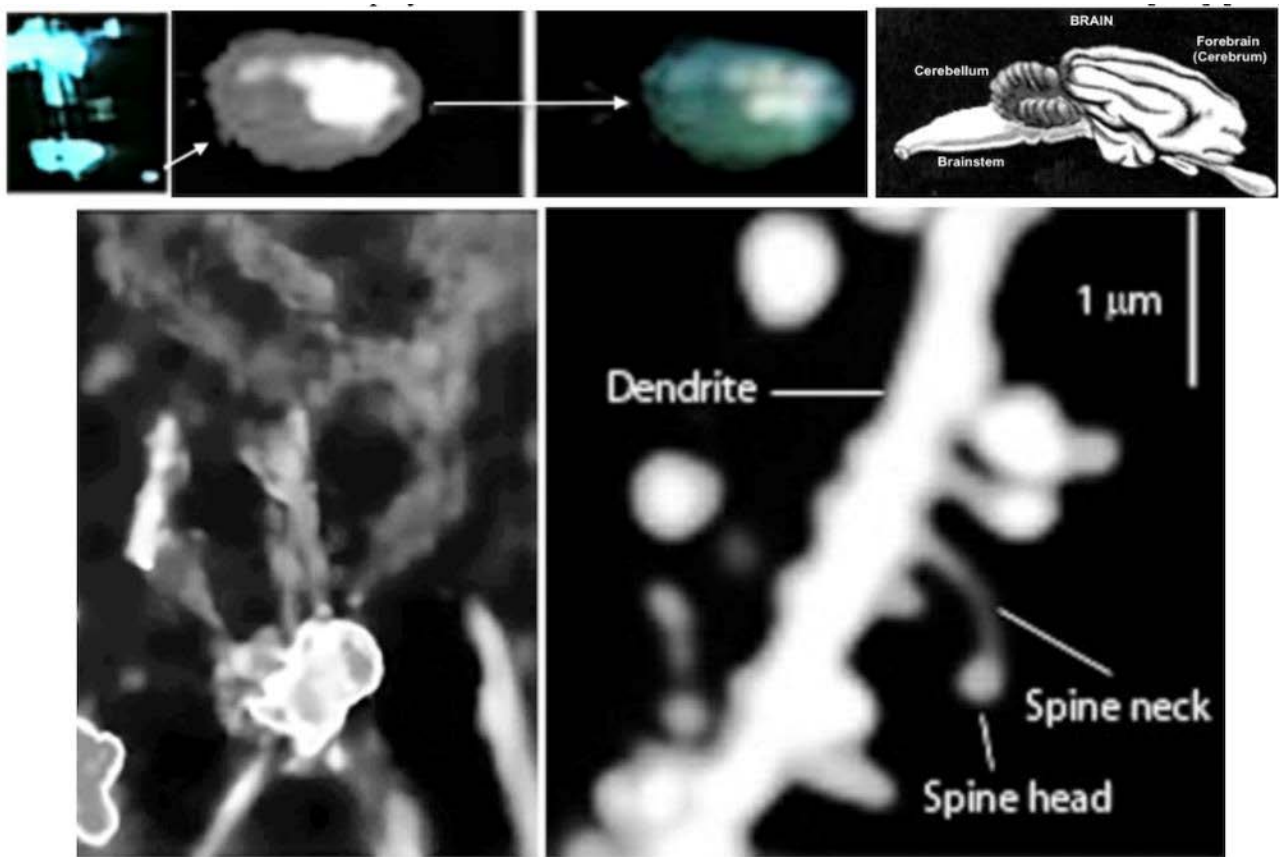


Figure 73. (Left) Networks of electromagnetic “rope” “cables” (Right) Dendrite and dendritic spine.

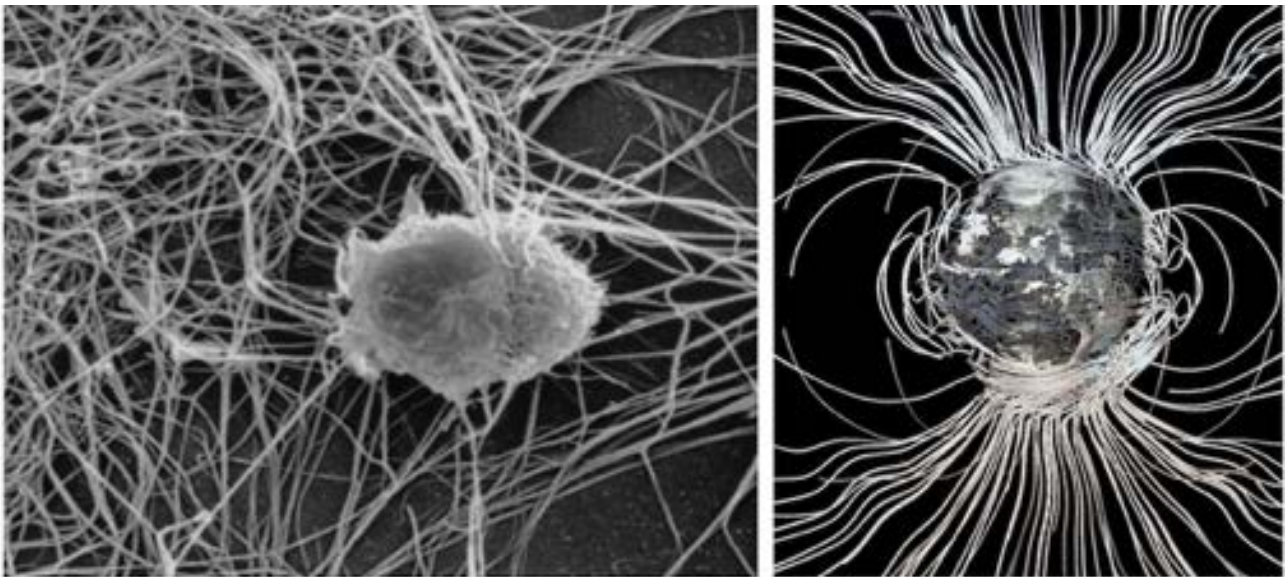


Figure 74. (Left) Neural networks, axons, dendrites, nerve cell. (Right) Magnetic flux ropes envelop Earth.

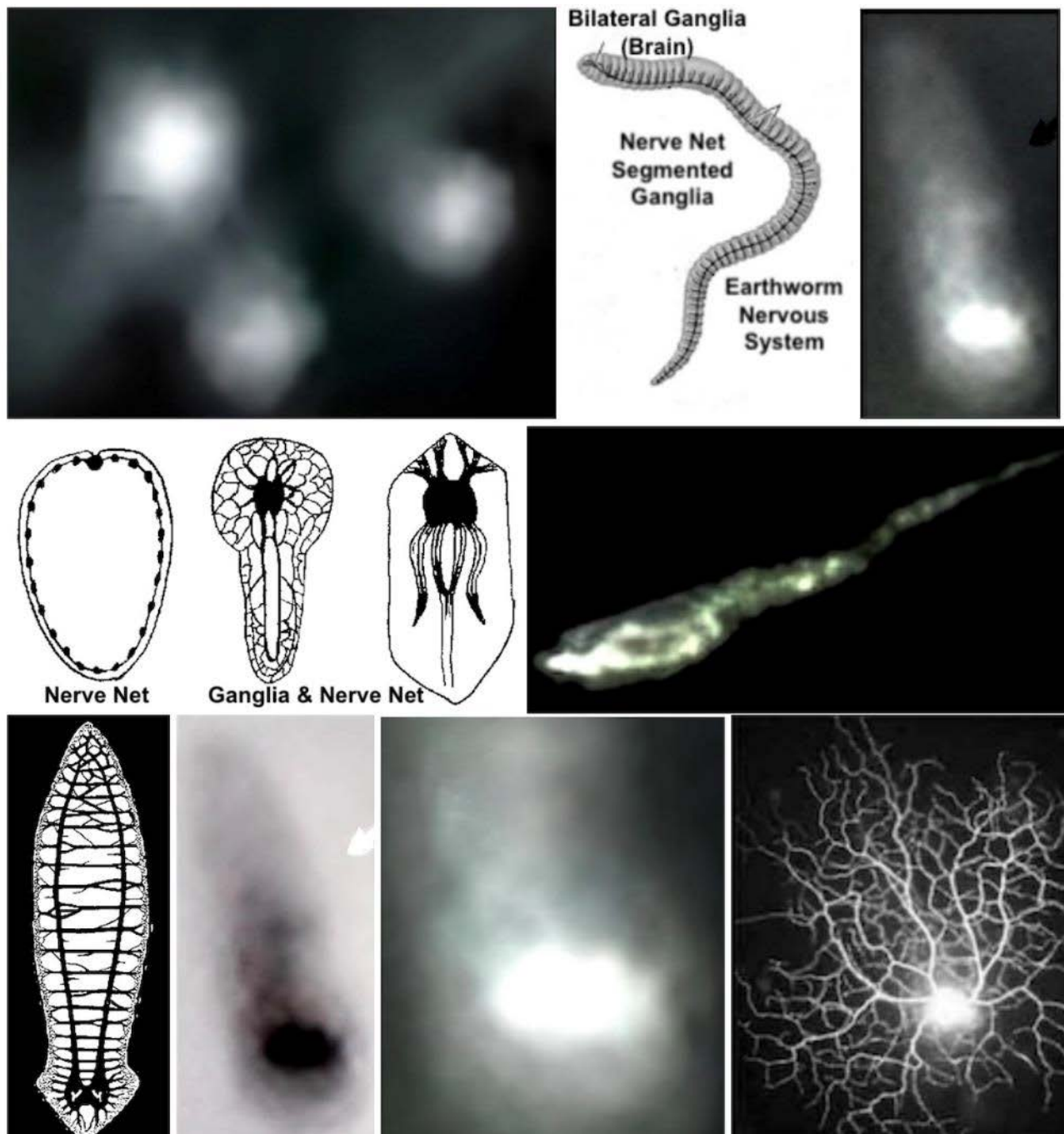


Figure 75. Electromagnetic “virtual” ganglia “nervous systems”? Plasma electromagnetic neural “networks”? Comparing the nervous system of invertebrates with the internal sphericals of plasmoids and what appears to be “ganglia” and neural nerve nets. The brain of eukaryotes is an electromagnetic organ and the nervous system functions according to and is governed by electromagnetic-plasma principles. Plasmoids may not have a “physical” “hard wired” nervous system, but a virtual electromagnetic nervous system whose nerve network and circuitry is purely electric but which may have incorporated charged particles, dust, and debris, thereby creating stable interconnected electric circuits and ganglia that function in a manner similar to the eukaryotic nervous system.

29. Plasma Patterns Repeat

Pattern repeat in nature, even if only approximate: Fractals, spirals, vortexes, meanders, waves, bubbles, spots, stripes, and so on, repeat; from snail shells to

spiral galaxies [18]-[25] [136] [137]. Plasmas in the thermosphere also appear to display patterns common on a solar and galactic level; e.g. comets, colliding galaxies, and perhaps pulsars in respect to plasmoidic oscillations in dim vs bright light: except that pulsars spin whereas these oscillating plasmas shrink and expand.

There is now abundant observational evidence that magnetic flux filamentation occurs and is common at all astrophysical levels [10] [12] [31] [97] [99] and that that generates structures on smaller and smaller scales from galaxies to stars to planets, and perhaps to the scale of the nervous system. Magnetized plasma ropes, cables, and filaments have been observed at the scale of superclusters interconnecting multiple galaxies, within clusters, along galactic spiral arms, within star forming molecular clouds, within solar system, above the sun, in the magnetosphere/plasmasphere [121]-[123] [128] [175]-[177] and in the thermosphere as documented in this report.

Plasmas in the thermosphere pulsate with light. Red giants also pulsate (e.g. Betelgeuse, Mira A), as do binary stars and “variable stars” which may have regular or irregular pulsating patterns-possibly because there are electrical discharges between nearby stars.

Plasmas (Floaters) form semi-conglomerates of semi-stationary plasmoids grouped together, or in which one within a grouping will orbit around and make contact with the others; and/or which are interconnected with luminous clouds of plasma. Such grouping and behavior are also common at astronomical levels. Consider Sirius, the “Dog star” in the constellation of Canis Major. It has a companion star, Castor which in turn appears to be made up of six small stars that slowly revolve around each other.

And then there are the thousands of galaxies that appear to be colliding. Plasmas also collide.

Arp [178]-[182] has documented and photographed numerous physical connections between galaxies, including those with high vs low redshift values-connected by a luminous bridge or tail, as well as hundreds of galaxies that appear to be interacting.

Plasmas streak at varying velocities across the thermosphere, targeting and colliding with other plasmas and often leaving a plasma-comet-like tail in their wake; whereas comet luminosity has been attributed to electrical excitement [14] [15] Comet Halley, for example, flared up between the orbits of Saturn and Uranus—which means the heat from the sun could not have been the trigger—and left in its wake clouds of illuminated dust that stretched more than 300,000 KM. Be they large or small, comets frequently display “non-gravitational” erratic motions, as do plasma Hunters in the thermosphere. And comets produce filamented plasma tails that may stretch for tens of millions of kilometers across the solar system whereas Plasmas in the thermosphere produce filamented plasma tails that may stretch tens of km.

Plasmas, therefore, display patterns that repeat.

30. Properties of Life

Defining life has always been challenging for both biologists and philosophers [183] [184] especially as it is a functional process and not easily defined in structural terms [185]. This is a particularly acute dilemma with reference to the plasmoids as their “structure” is unclear and what can be observed shows no direct or obvious parallels with that of organic life forms and therefore, much of our discussion of whether they are “living” relates to their observed functional properties and behavior.

There are over 120 published definitions of “life” reflecting the lack of a current consensus [86]-[187] Nevertheless, there is a general consensus regarding the properties that an entity should possess to be regarded as “living”; *i.e.* the 7 properties [186].

First, is homeostasis, the regulation of an internal environment to maintain stability. The plasmoids appear to be stable physical structures which and comprise an inner and outer layer as well as dust, particles, and debris, all of which differ in charge. Hence, there is the possibility, for example, of the processes of ion exchange across these boundaries which could contribute to stability.

Second, is “organization”, which in examples of terrestrial life forms is composed of one or more cells. Plasmoids do not appear to have a conventional “cellular” structure but to have a more diffuse morphology, coupled with multiple layers, internal globular and helical structures, a nucleus, and an aggregations of subunits.

Third, is “metabolism, the conversion of energy to make structures (anabolism) or its decay (catabolism). The plasmoids if bounded by a boundary layer and with an internal structure may build and maintain their structure using electromagnetic energy.

Fourth, is “growth” which is defined as an irreversible change in size regardless of the method of measurement [188] and occurs when anabolic processes exceed those of catabolism. The size frequency distribution of plasmoid area in some time periods appears to be highly positively skewed and similar to that of growing terrestrial organisms but it is difficult to determine whether this is attributable to actual variation in size among individuals and their possible growth or to different distances from the tether.

Fifth, is “adaptation”, an evolutionary process in which terrestrial organisms change in structure and/or function to become better adapted to their environments [189]. The hypothesis that dusty plasmoids have incorporated RNA/DNA into and the possibility that the nucleic acids have some function in controlling their existence, raises the possibility of genetic change and adaptation.

Sixth, is “response to external stimuli” resulting in change in behavior. The plasmoids show a number of examples of this type of response, including attraction to sources of EM pulses, aggregation in response to them, and their behavior as individuals.

Seventh, is “reproduction” involving either a sexual or asexual process. This report provides examples of plasma mitosis, the ejection of clouds of plasma prior

to and after collisions between plasmoids and the ejection of mini-plasmas; processes that appear to represent a form of reproduction and subsequent growth. Hence, although it is not possible to demonstrate that all seven characteristics of life are present, this report provides sufficient information to conclude that plasmoids likely constitute a “form of life”.

31. Speculation: Quantum Physics of Microtubules, Plasmoid Macrotubules: Universal Consciousness

Based on the data presented in this report it can be argued that plasmas/plasmoids in the thermosphere may represent a fourth domain of life and, as documented, many exhibit complex life-like behaviors including mutual awareness and thus: consciousness of their surroundings. Most physicists agree that over 90% (maybe 99%) of this universe consists of plasma; and according to Alfvén [10]-[12] this cosmic universal plasma has cellular layers and membranes. If plasmas/plasmoids in the thermosphere are alive and conscious, then it could also be argued that 99% of the universe is conscious.

On the other hand plasmas in the thermosphere appear to be distinct from the surrounding universal plasma in that they have structure, form, shape, a nucleus, and possibly a genome and virtual nervous system and engage in complex behaviors and interactions. However these latter plasmas also appear to be directly linked to a surrounding plasmoid network of macro-tubular flux cables that also resemble a virtual nervous system.

To speculate: Does the upper atmosphere of Earth (the thermosphere-plasmasphere) consist of plasmodic macrotubules that are interlinked with plasmas/plasmoids and all of which are alive, sentient, and conscious? Might 99% of the universe also consist of macro-tubular flux cables which are also capable of consciousness?

According to Orch OR theory [190]-[194] the quantum physics of consciousness is made possible via the microtubules within each and every neuron which, via action potentials, amplifies the electrical and magnetic oscillations which maintain quantum states (*i.e.* superposition) for at least 10^{-6} seconds. This brief moment of time is sufficient for quantum wave information to be transmitted by neurons that share a common quantum wave function (so called Bose-Einstein Condensates). Therefore, via these microtubules, wave information can be transmitted to and from the brain by quantum wave resonance and which may cause wave form collapse and decoherence making possible perception and consciousness of what appears to be individual objects through conscious observation.

Therefore, quantum coherence or decoherence in these microtubules and collapse of the wave function may enable consciousness to emerge and to become conscious of consciousness-as predicted by quantum physics [195] and Orch OR theory [190]-[194] the latter of which however, could be interpreted as indicating that a brain per se is not necessary for consciousness [196].

It is well established that patterns repeat, such that similar forms exist from the

micro to macro; from snail shells to hurricanes to spiral galaxies. Might the macro-tubules identified in the report represent a macro reproduction of microtubules? Could an interaction between macro-tubules and micro-tubules generate or make possible a universal consciousness, fragments of which give rise to human consciousness and consciousness per se?

Consciousness is always a consciousness of something [195]-[199]. Consciousness requires a duality in order to exist as a consciousness; something to be conscious of which then exists an object of consciousness [195] [196] [199]. As summed up the Heisenberg [195], one of the founders of quantum mechanics: “What we observe is not nature in itself but nature exposed to our method of questioning the transition from the possible to the actual takes place during the act of observation and the interaction of the object with the measuring device, and thereby with the rest of the world through observation our knowledge of the system has changed discontinuously, its mathematical representation has also undergone the discontinuous change and we speak of a quantum jump” [195]. In other words, something comes into existence, by becoming conscious of it.

According to the Copenhagen model of quantum physics, what is perceived as form and substance are manifestations of dynamic patterns of energy and electromagnetic radiation that have no material reality [200]-[205]. Form and substance, that is, the “particles” and waves they are comprised of, exist only as probabilities and only have probable existences and display tendencies to assume certain patterns of activity that is perceived as shape and form [200]-[211].

Because this electromagnetic activity is so frenzied, the rapidity of movement obscures the fact that much of what we perceive are particular patterns of electromagnetic activity; a function of our perception of these dynamic interactions within the frenzy of activity which is the quantum continuum. However, we can only perceive what our senses can detect, and what we detect as form and shape are really a mass of frenzied subatomic electromagnetic activity that is amenable to detection by our senses and conscious mind at a particular moment in time, which give rise to the impressions of shape and form. If we possessed additional senses, or an increased sensory channel capacity, we would perceive yet other patterns and other realities.

Heisenberg [195] cautioned, however, that the observer is not the creator of reality, but instead merely registers, at a particular moment, certain isolated fragments of activity within the continuum, the nature of which is shaped and determined by our senses. The act of observing, or measuring and interacting with the environment creates an entangled state of energy in the quantum continuum described as a “collapse of the wave function.”

Hence what we perceive as mass (shape, form, length, weight) are dynamic patterns of energy which we selectively attend to and then perceive as stable and static. And, we are perceiving only fragments of the quantum continuum. This energy that makes up the object of our conscious perceptions, is but an aspect of the electromagnetic continuum which has assumed a specific pattern that may be

sensed and processed by our brain and in so doing becoming an object of consciousness. Consciousness is entangled in the continuum [196] [212]-[215] and by the act of observation or measurement creates a discontinuity within the quantum continuum; *i.e.* a wave form collapse [195] [200]-[205]. As based on the Copenhagen theory of quantum mechanics what we perceive as reality are a manifestation of wave functions and alterations in patterns of activity within the quantum continuum which are perceived by consciousness as discontinuous.

According to Heisenberg [195] because the physical world is relative to being known by a “knower” (the observing consciousness), then the “knower” can influence the nature of the reality which is being observed through the act of measurement and registration at a particular moment in time. And yet, what is observed or measured at one moment can never include all the properties of the object under observation [208] [209].

Moreover, wave form collapse is always a matter of probability [208] [209], and is non-local, indeterministic and a consequence of conscious observation, measurement, and entanglement. Consciousness and the act of measurement, therefore, are entangled with the quantum continuum and can alter the continuum and the space-time manifold [195] [196] [200]-[205] [212]-[216]. Therefore, based on quantum physics, it can be theorized that the universe—the quantum continuum—is conscious of itself as the universe, and via consciousness created the universe which is conscious.

Penrose and Hameroff [190]-[194] regards the quantum world and the un-collapsed wave function as having objective existence. They propose that the collapse of the quantum wave function makes manifest that objective existence and that the objective reality of the quantum world allows it to play a role in consciousness. Therefore it is consciousness that collapses the wave function—a view basic to quantum theory. Hameroff and Penrose sees consciousness as not only related to the quantum level but also to space-time. According to Hameroff and Penrose [190]-[194] the discovery of quantum vibrations in “microtubules” corroborates their theory—though others disagree. Penrose and Hameroff argue that consciousness depends on biologically orchestrated coherent quantum processes in collections of microtubules within neurons; and that these quantum processes correlate with, and regulate, neuronal synaptic and membrane activity and which gives rise to highly structured extracellular electromagnetic fields.

Presumably, it is these electromagnetic fields that link the brain, or rather, the consciousness associated with neural activity to the collective consciousness of the quantum continuum. If this theory is correct, then a brain, *per se*, is not necessary for consciousness to exist, but rather, these electromagnetic fields and waves, and quantum plasmodic tubular entanglements are in themselves, a form of or give rise to or support consciousness.

As manifestations of the continuum, the implications are that every living organism is, at a minimum, sentient and capable of some form or degree of “consciousness” depending on the power and strength of that organism’s electromag-

netic field. This would explain why numerous experiments have demonstrated that plants—although lacking a nervous system—are “aware” of their environment and not only sense but respond to changes in light, touch, chemicals, temperature, and other stimuli around them, including threats of injury [173] [174].

Awareness, however, is not the same as “consciousness” [199]. For example, one might be a passenger on a bus, focused on their cell phone, conscious of the words and images displayed, while simultaneously aware but not conscious of “sounds” “movement” other persons on the bus, cars going by, etc.—these extraneous experiences remain outside consciousness, but may become an object of consciousness. Consider “blind sight.” Although there is no conscious perception of visual stimuli due to destruction of the visual neocortex in the occipital lobe, there remains an unconscious awareness which, via subcortical visual centers in the thalamus and brainstem, may enable that “blind” person to walk around furniture, grasp or even correctly “guess” at the name of an object held before them, despite reporting no conscious visual perception of their external environment.

Speculation: The brain generates electromagnetic fields. The implications are that plasma—which generates a powerful electromagnetic field—is at a minimum, sentient and aware, and may achieve consciousness if the electromagnetic field is sufficiently powerful. This would also imply that plasmoids in the thermosphere may be capable of consciousness and that the sun is also sentient and conscious—a belief held by numerous civilizations for thousands of years.

However, it is also reasonable to ask: lacking a nervous system—or at a minimum (given ORCH OR) microtubules—how would it be possible for a plasmoid or the sun to maintain something akin to “consciousness”?

32. How Consciousness Became the Universe and Created Itself: The Universal Mind

Perhaps what could be considered a global “consciousness” is maintained by plasma—that plasma and the plasma universe has consciousness, and what resemble universal *macrotubes* flux chains of “rope cables” function as a quantum manifestation of a virtual nervous system that is interlinked not only with the plasmas of the thermosphere. To speculate: the plasma universe may be permeated with flux chains and these interacting plasmas give rise to atoms, molecules, meteors, asteroids, comets, moons, planets, suns, stars, the universe via consciousness [196].

All of existence emerges from the quantum continuum and returns to the quantum continuum.

In the upper atmosphere of Earth and perhaps in this solar system, these twisted strands of macro-tubular plasma are related to and may be a manifestation of or derive energy from solar electromagnetic activity. Like micro-tubules, these electromagnetic macro-tubule rope-chain cables have a tubular geometry and are commonly detected on the surface of the sun and in the magnetosphere—the latter a function of the solar wind and interactions with the magnetic fields and mag-

netic clouds produced by coronal mass ejections. These rope cables, therefore, are electromagnetic plasmas that produce additional plasmas and which may also function as a “virtual nervous system” in a manner similar to and which may link the neuronal-axonal-dendritic nervous system of biological organisms and the human brain.

Speculation. Possibly, this “virtual” electromagnetic “nervous system”—a manifestation of quantum states and solar activity in this solar system—has consciousness. Perhaps every solar system maintains a solar consciousness; and which would imply that collectively, these “solar minds” would give rise to a galactic consciousness; and thus, every planet, every solar system and every galaxy in this universe has consciousness and which collectively give rise to the consciousness of the universal mind that is the quantum continuum.

In the Copenhagen model, objects which are best described by the wave function and the probability function. “The reduction of wave packets occurs when the transition is completed from the possible to the actual” [195]. Since the universe, as a collective, must have a wave function, then this universal wave function would describe all the possible states of the universe and thus all possible universes such that there must or may be multiple universes which exist simultaneously as probabilities [217]-[221].

According to the Copenhagen mode of quantum physics, and as conceptualized by Everett [221] and DeWit [219] [220] all probable universes underwent a transition from the probable to the actual, at the moment of conscious registration which triggered a wave form collapse. Because the wave function of consciousness is entangled with the quantum continuum it can cause a collapse of the wave function. If consciousness is energy, then the energy which is the quantum continuum also has the probability of becoming conscious. If the universe, as a whole, is a manifestation of the quantum continuum, as perceived by consciousness, then the continuum could have become conscious of itself, and in achieving self-consciousness, created the universe. Therefore, this universe exists, because there is consciousness of this universe. Therefore, consciousness must have come first. First there was consciousness, then the universe became the universe via wave form collapse.

But where did this “first” consciousness come from? The implications are that the quantum continuum—this seething cauldron of electromagnetic activity—is conscious: A collective quantum consciousness which is the universal mind.

However, consciousness is always consciousness of something. Therefore, it can be said that the consciousness that is the quantum continuum became conscious of its existence and thus “self-conscious” via a collapse of the wave function. such that this electromagnetic potential universe came into existence via a collapse of the wave function. Given that consciousness is always consciousness of something, then prior to consciousness this universe did not and could not exist until it became an object of consciousness. This duality in turn became a multiplicity (atoms, molecules, moons, planets, stars due to repeated collapses of the wave func-

tion. Each of which could also form islands of conscious awareness interlinked with the universal mind.

Because the quantum continuum has the potentiality of creating innumerable probable universes it is also probable that this universe became this universe when another universe became conscious of this universe. However that would require an infinite regression of universes becoming conscious of other probable universes. And the only answer to this paradox is that all probable universes—the electromagnetic quantum continuum and the plasma universe in its entirety—became conscious simultaneously thereby giving rise to the collective quantum consciousness which is the universal mind.

Hence, via quantum consciousness of the electromagnetic continuum, this universe-out of all possible universes-underwent a transition “from the possible to the actual” [195]. And by becoming conscious of *its* existence, the continuity of “one” became a duality (wave particle/consciousness of consciousness). And via an infinite progression of collapsing wave forms this duality became the many as contemplated by the conscious human mind that itself is entangled and a fragment of the plasma consciousness surrounding Earth, the solar consciousness, the galactic consciousness, and the universal mind.

The first author of this report believes these findings imply that the micro-tubules-neurons-neural networks that comprise the human brain and give rise to human consciousness, may be acting as a quantum “receiver” and “transmitter” that is entangled with and tunes into select channels and fragments of the collective universal mind.

33. Conclusions

The data presented here, combined with our previous reports, challenge all conceptions of what constitutes “life,” the origins of life, consciousness, and Unidentified Anomalous Phenomena [1]-[5] [112]. We have provided an extensive review of the scientific literature and present pictorial evidence and the results of two major statistical studies in support including detailed quantitative statistical analysis of Plasmoid behavior and morphology.

It is widely accepted that plasma constitutes 99% of this universe and a “fourth state of matter” whereas Alfven [10]-[12] considered plasmas to be the “first state of matter.” As detailed in this article, and as supported by the results from two extensive quantitative statistical studies reported here: plasmas in the thermosphere demonstrate mutual awareness and engage in complex behavior and interactions that appear life-like, purposeful and under intelligent control. Therefore, plasmas *may be* alive and *may be* sentient and *may* represent a fourth domain, or even a first domain of life that is mutually aware and conscious.

In this solar system, in the atmosphere above Earth, it can be assumed that the plasmasphere (magnetosphere) has been in existence for at least 3.5 billion years following the great bombardment of meteors, asteroids, comets, and oceans of ice. We have hypothesized that over the ensuing billions of years, that dusty plasmas

incorporated the shattered remnants of meteors and all the necessary ingredients for the fashioning of RNA and DNA, and later incorporated the genomes of living creatures that were cast into the upper atmosphere by powerful winds, hurricanes, tornadoes and bolide impacts. These theoretical scenarios give rise to at least four hypotheses: 1) Dusty plasmas are the first domain of life and incubated and synthesized RNA, then DNA thus leading to the origins of life. 2) Dusty Plasma acquired RNA/DNA after incorporating and encapsulating innumerable living organisms that were cast into the upper atmosphere. 3) Dusty plasmas were the first to synthesis RNA and DNA, and upon acquiring and encapsulating organisms propelled into the upper atmosphere, incorporated their DNA into the plasma DNA via horizontal gene transfer. 4) Plasmas (plasmoids) are a form of “pre-life” or an inorganic non-biological form of “life” which function according to the same principles of electromagnetism that govern the functioning of living organisms, be they plants or organisms whose behavior is controlled by a brain.

It has also been hypothesized that plasmoids-hunters in particular-may have developed a virtual plasma-based nervous system. The brain of eukaryotes is an electromagnetic organ and the nervous system functions according to and is governed by quantum and electromagnetic-plasma principles. However, we are not proposing that plasmoid have a “physical” “hard wired” nervous system, but an electromagnetic virtual nervous system that is electric but which and incorporated charged particles, dust, and debris, thereby creating stable interconnected electric circuits and ganglia that function in a manner similar to the eukaryotic nervous system; and which provides the foundation for sentience, intelligence, and consciousness.

The fact is, as documented in this and earlier reports and the results from major statistical studies, plasmas in the thermosphere have diverse morphologies and engage in complex behaviors and interactions. These include what may be communication via a language of light with some plasmoids rapidly oscillating in brightness and size as they approach vs pass by other plasmas. Then there are the ejection of clouds of plasma in their wake, the formation of plasma bridges between one or more plasmas and plasma mitosis and the secretion of “emissary” “messenger” plasmas that detach (repulse) and may then be drawn toward the plasma that triggered the fissioning. This same principle may apply when two plasma targets and crash into one another, or when plasmas merge, they separate.

Plasmas/plasmoids in the thermosphere are attracted to electro-magnetic activity and descend into lightning thunderstorms. Once in the lower atmosphere, they likely engage in the same complex behaviors as documented in the thermosphere and when observed or encountered, are commonly referred to as UFOs and UAP.

The data reported here and in our previous reports support the hypothesis that plasmoids may have acquired a DNA-RNA based genome, plasma-like neural-like networks, and are alive, mutually aware, and conscious. Further, the discovery of vast plasma macro-tubule flux cables and neural-like networks in the thermosphere, which may be giving birth to and to which plasmoids interact, gives rise

to the hypothesis proposed by the first author of this report, that what has been referred to as the plasmasphere may also be conscious, and that by extension, and since approximately 99% of the universe may consist of plasma, that the sun, the solar system, the galaxy, and the plasma universe may be conscious and collectively generating a collective cosmic consciousness which encompasses and makes possible what appears to be consciousness in living organism.

These theories and hypotheses, although supported by factual, photographic, film, and quantitative data and evidence, are not conclusively proven facts. Each of these plasmas may have different voltages, densities, temperatures and chemistry, which may rapidly change, and all of which generate electric currents and charge separation, especially when they crash through and pierce each other. Therefore, all these interactions and complex behaviors, including variable shape-shifting morphologies, *may be* entirely due to differential electromagnetic activity and negative vs positive electrical charges and push-pull magnetic repulsion and attraction, as similar interactions have been observed between galaxies, pulsars, binary stars, and “red giants.” On the other hand and by contrast, if the plasmas in the thermosphere are alive, then it could be said that the plasma universe, the electromagnetic quantum continuum, is also alive and conscious, giving rise to a universal mind that functions according to plasma and quantum physics.

Admittedly, we cannot provide definitive, conclusive answers to any of these questions. We have repeatedly proposed that additional research should encompass the creation of a robotic-alien-hunter satellite designed to attract, film, and possibly capture plasmoids in the thermosphere. Absent additional data, then, we can only conclude that the data presented challenges all conceptions of UAP, the nature of consciousness, and what constitutes “life” and how life began.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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