FOUNTAINS IN VACUUM (2006 March 18 koppes)
Enceladus

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SUMMARY

A discovery can be born via an electric model of filaments. This model uses the electric repulsion and the pinch-effect. Recently, photos of Enceladus showed about 9 fountains. Tempel 1 showed about 16 fountains when impacted. Also the Moon has ray craters. In each case we see a beautiful system of radial, equally thin and very long fountains. They need vacuum for ionization. Particles are ionized by the solar UV and X-ray photons or by an impact; therefore, they repulse each other electrically, are ejected from the positive surface and shaped to thin, long fountains by the pinch effect. These 500km long fountains can be modelled in a laboratory.

INTRODUCTION

The fantastic development of astronomy shows daily new filamentary bodies but not their model. Recently, the spacecraft Cassini sent frames about the beautiful fountains ejected by Enceladus of Saturn (Fig.1). If the electric model of these fountains will be confirmed, then other filamentary bodies can easier be explained, too.
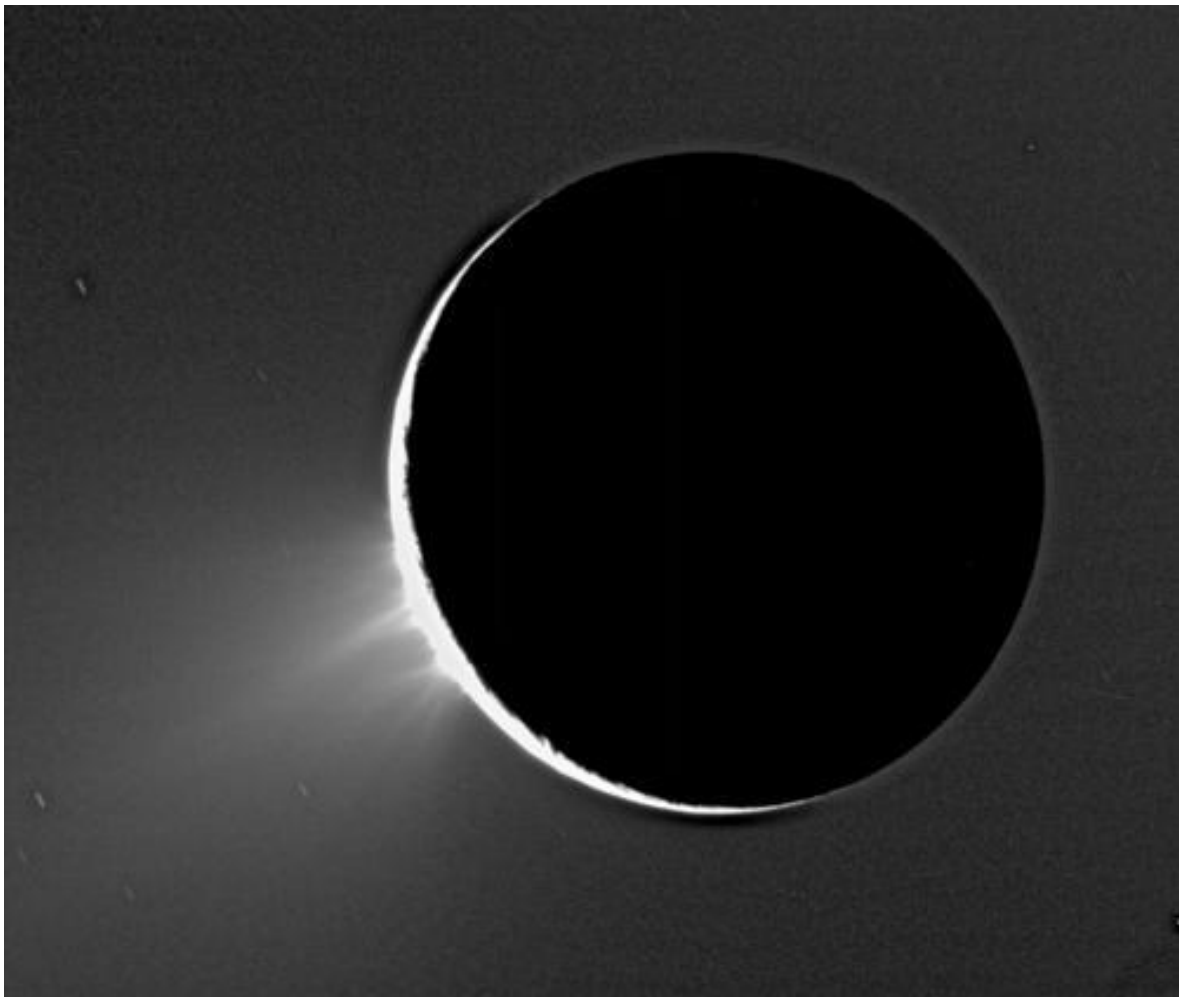

Fig.1 The 9 nearly equally thin, long and straight snow-fountains of Saturn's moon Enceladus. They are ejected almost perpendicularly from the irradiated sickle. The Cassini-team made 4 photos in a movie in which the surface (deep black) rotates below the non-rotating fountains. This photo was taken in 2005 Nov.27, shortly after the solar activity shown in Fig. 2. The fountains were reported to be longer than the moon-diameter of 505km. Curiously, the fountains are not bent by the Coriolis-force. The start-distances between two fountains are roughly equal. All the 9 fountains seemingly lay in one plain of the terminator and no other fountains can be seen.

The Apollo 17-team made more sketches about similar fountains on the Moon already in 1972. These Moon-fountains were ejected also at the terminator (which lies between day and night as here in Fig.1). Apollo 17 even transported a special instrument to measure the electric charge of the ejected dust of the Moon fountains. After this, no mention of this process was found [1]. The spacecraft Cassini can also measure electric charges of dust as low as 10^{-15} coulombs [2]. Fig. 1 gives the impression of terrestrial volcanic geysers in which water flows into deep hot cavities and is ejected periodically.

ENCELADUS IS NOT A VOLCANIC BODY

Tidal forces feed the volcanoes of Io (at Jupiter) but probably not the fountains of Enceladus because the moon Mimas orbits nearer to Saturn and Mimas shows no fountains. Volcanic fountains could be also caused by a larger body of enough radioactivity (e.g. Venus, Earth, Mars). Density of Enceladus of 1200 kg/m^3 is too low to contain enough uranium [4]. Even the fountains of Yellowstone are only 90m high. 500 km are simply by orders too high.

In vacuum, volcanic water-fountains of a length of 500km would not have the form of a thin fountain like that in Fig.1 but a round exploding cloud due to the boiling of water. Hot or cold water would similarly boil. These "fountains" would be similar to the round ejection-cloud of the space rockets in vacuum or to the round volcanic cloud of Io in vacuum. Each "water-fountain" of Enceladus would be a huge sphere as large as Enceladus itself.

Fountains of water-geysers cannot spy continually; however, all 9 fountains of Enceladus have their total length of 500km and no length of only e.g. 60 km after a stop of heating up. Fig.1 would show turbulences at least between two neighbour-fountains due to their different velocities of their elevations; but no turbulences can be seen.

Taken in 2005 Nov. 27, a four-frame movie (http://ciclops.org/view_event.php?id=51) shows that the surface of Enceladus quickly rotates but the 9 fountains do not rotate with it! The fountains start from the moving line of the terminator! If other fountains in shadow existed, at least the top of some 500km long fountains would be visible. Volcanic fountains would spit into random directions, and not in the same plain. These fountains do not show any trace of the huge Coriolis-force! They are not bent even at the radius of three Enceladus-radii! They in Fig. 1 have a straight and regular form but geysers are dancing and irregular.

Four fountains of Enceladus form pairs; they seem to attract each other (in Fig 1. above). After a long flight, these fountains do not stop and fall back on Enceladus like volcanic geysers. Contrarily, they seem to escape their gravity for ever.

THE FOUNTAINS OF ENCELADUS DO NOT FOLLOW A MAGNETIC FIELD

The form of the fountains suggests an invisible tube which would force the particles to flow in a certain direction. If the fountains would fly in a supposed "magnetic tube" due to their ionization by the sunshine, the Lorenz-force would be zero i.e. force lines would be parallel to the velocity of the particles. Therefore, a magnetic field could only form a fountain but not also move the particles in the fountain, even if this field existed.

Magnetic force lines would return into the body of Enceladus showing a closed field, but these fountains are open, they fly constantly upward. The fountains (Fig.1) are starting from about 9 different positions, not from one (supposed) magnetic pole. In Fig.1 the fountains conspicuously start from the area of the strongest sunshine which quickly wanders and, therefore, they cannot remain identical to the magnetic pole which is fixed in each case.

THE FOUNTAINS OF ENCELADUS ARE FORMED AND EJECTED ELECTRICALLY

Mostly, the electric force is not taken into account in astrophysical models. The e.g. solar proton storms are exactly measured but not explained. How do these protons separated from "their" electrons, how they do start in minutes, how are these protons accelerated to fantastic energies to e.g. 100 million electronvolt, how are they stopped quickly again – these questions remain unanswered since decades. Magnetic models have the problems that they use a supposed magnetic field to form the emitted filaments but the emission itself, the

ionised and moving matter, its circular cross section, the emission of e.g. radio-waves with sinking frequency and hundreds of other characteristics [3] are not explained. The discovery of a new state of matter should be found for this explanation [5].

The only exception of all astrophysical models so far is the model of the electrified dust during the Apollo Moon-program. Similar to a music plate of 33.3 rpm which was forgotten in the player and became a dust layer due to its electrostatic charge, the astronauts and their auto became a dust layer on the Moon. They suffered by this electrified dust which found its way even to their naked body. Importantly, astronauts landed in any case on the Moon-terminator for better orientation via shadows. This electrified Moon-dust was in the hands of astronauts and, therefore, it plays a role in the explanation of the lunar dust fountains, see overview in [2]. Mostly it is supposed that the Sun should positively ionize the dayside of the Moon and the Sun should send its aurora-electrons and should negatively charge the lunar night-side. So a horizontal electric field comes into existence at the terminator. This electric model correctly shows the terminators as sites of the fountains. However, this horizontal field cannot form and eject vertical fountains like those in Fig.1.

A suggested new electric model is shown below on the base of [3]:

The Millikan test proves [4] that already one knocked-out electron produces a microscopic movement of an oil-drop in an electric field. However, in the fountains, many electrons of a snow crystal or a dust-grain can act. It is easy to calculate [4] that already one knocked-out electron elevates a particle. Parameters of the elevation are [4]:

- The dust diameter is smaller than 0.1 mm,
- many particles are smaller than 0.1 mm below this particle,
- each particle is at least charged positively with one missing electron.

The fountains in Fig.1 start from a sickle-area of the strongest visible sunshine (on the left and slightly downward). This observation suggests the Sun as the source of the energy of these fountains. Also the team of Apollo 17 found such fountains which have been sketched out by them [2]. The solar UV-, X-ray- and gamma-photons (up to 10MeV) ionize dust grains everywhere in sunshine on the Moon or Enceladus because no atmosphere stops them.

Let us estimate if the solar irradiation can eject these fountains at all. The ionization can have an electric power of at least 1-10% of the solar irradiance which is estimated 10 W/m^2 at Saturn. Therefore, the solar electric power can be about 100 MW of irradiated area in Fig.1. The Cassini team estimated that Enceladus ejects 360kg snow by the fountains [1].

The necessary power to eject this 360 kg snow with a velocity of e.g.100m/s would need only 1.8MW - which is clearly less than 100MW by the irradiation.

After the knocking-out of an electron from a particle, the created positive charge attracts the knocked-out electrons. So, many slow electrons return to the ionized particles and re-neutralize them. Matter of Enceladus is of metaloxyds (e.g. SiO_2). These are good electric isolators. The electric charges flow only very slowly in the body.

A knocked-out electron normally flies along the extrapolation of the orbit of the solar photon. Therefore, these electrons mostly fly back into the surface of Enceladus. For example, a knocked-out electron "is born" in a snow crystal and this electron flies only some millimetres into a dust grain below this crystal. No durable ionization occurs by normal solar irradiation e.g. during noon on Enceladus.

The only exception is the ionization at the terminator i.e. during morning and evening on Enceladus. There the photons fly tangentially to the surface of Enceladus and the knocked-out electrons fly tangentially away and they often have no more collisions with the surface. These electrons fly along the extrapolated orbit of these photons into the infinite vacuum. In this perfect vacuum, the electrons fly 100-10000 km away in a second if they are knocked out tangentially by X-ray and gamma ray (during a flare like in Fig. 2). Some electrons get an "electrical escape velocity" i.e. these electrons never return to the irradiated surface. This positively charged surface of the tangential irradiation forms a "positive carpet" which is a thin and bright "sickle" at the footpoints of the fountains in Fig.1. The particles of it remain durably positive, because "their electrons" do not return.
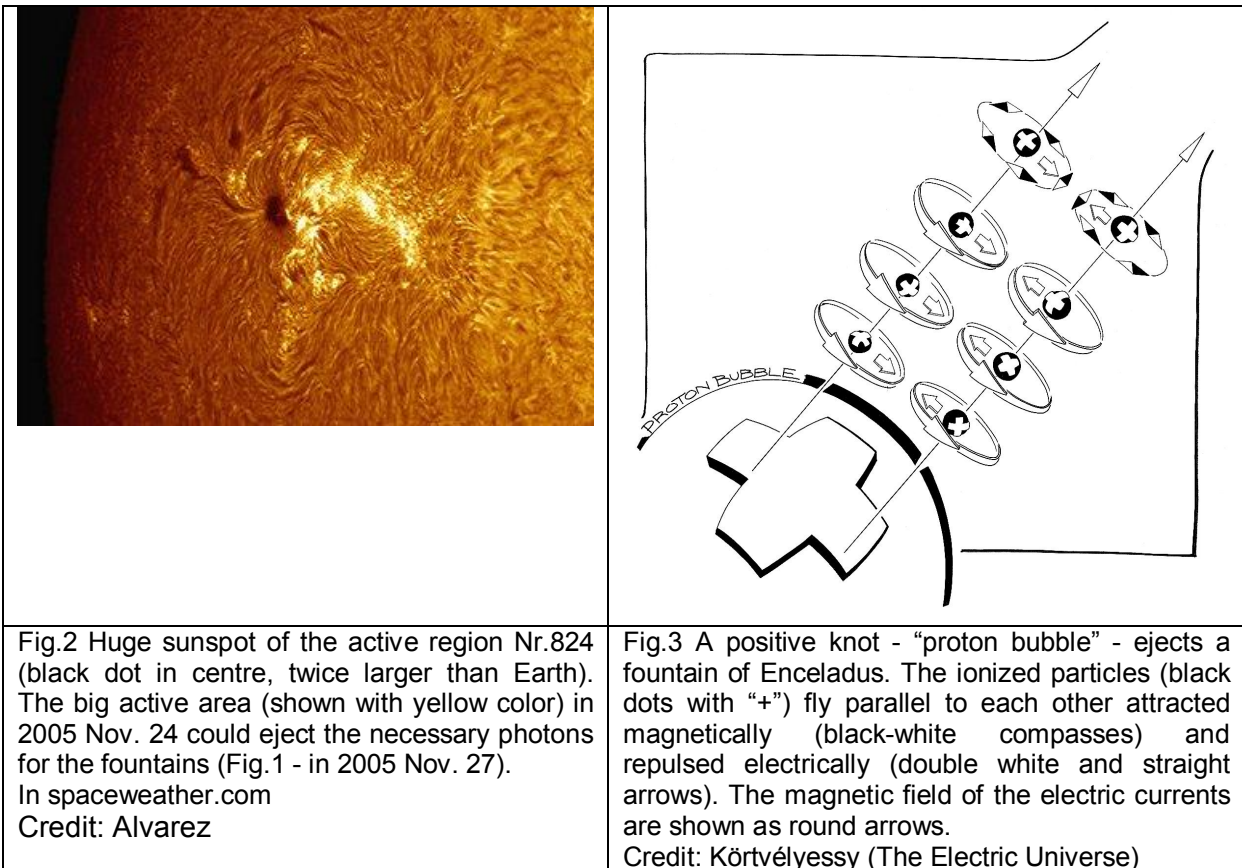
These particles electrically repulse each other and form the fountains by the pinch-effect. They fly parallel to each other in a fountain of a circular cross section (Fig.3).

At the terminator, always new particles will be ionized, "their electrons" never return.

An important support of this electric model of these fountains is the implied explanation of the start-position of fountains at the terminator - shown by a Cassini-movie.

A problem is however that the predicted Enceladus-fountains of the second terminator on the right in Fig.1 are invisible. Perhaps Enceladus has an icy region there and the electric charge cannot elevate this icy layer. Only small particles can be elevated.

The detailed model of the elevation (Fig. 3) is as follows: Snow crystals and dust on the "positive carpet" of Enceladus become positive on the terminator and they repulse each other. "Their electrons" are far away. This positive charge makes this layer wavy (these "knots" at the footpoints of the fountains are clearly visible in Fig.1). The "positive carpet" will be uneven.

Fig.2 Huge sunspot of the active region Nr.824 (black dot in centre, twice larger than Earth). The big active area (shown with yellow color) in 2005 Nov. 24 could eject the necessary photons for the fountains (Fig.1 - in 2005 Nov. 27). In spaceweather.com Credit: Alvarez	Fig.3 A positive knot - "proton bubble" - ejects a fountain of Enceladus. The ionized particles (black dots with "+") fly parallel to each other attracted magnetically (black-white compasses) and repulsed electrically (double white and straight arrows). The magnetic field of the electric currents are shown as round arrows. Credit: Körtvélyessy (The Electric Universe)

At the area of the highest charge density - at the largest knot - the positive surface-layer maximally repulses the positive particles above it and this repulsion elevates the particles of the charged highest dust layer. This repulsion is horizontally symmetrical in the surface from all directions; therefore, the positive particles emerge perpendicularly upward. Their velocities are perpendicular to the positive carpet and not to the geometric surface of Enceladus. A big knot (below in Fig.1) ejects three fountains in a cone of about 45°. As soon as the positive particles move upward, the pinch effect produces a thin fountain of a diameter of about 10 km (Fig.1-3).

The pinch effect is important in technique (Table 1) but rarely used in astrophysics. Some examples are shown. This ejection of the fountains (Fig.1) is similar to that of a stormy cloud of a diameter of e.g. 5km. The cloud emits its lightning and this high-velocity electric current will have a diameter of only 25mm due to the huge pinch-effect. The electrons repulse each other in lightning very strongly but the pinch effect is always stronger and holds all electrons together. Similarly, the electrons in the TV or monitor have about 30% of the

light-velocity and, therefore, a very strong pinch-effect. Due to this effect (Fig.3), these electrons fly with a circular cross section of a diameter of about 0.1 mm and remain together even after strongly inclined by magnetic fields. Without the pinch effect, they would fill the whole cone and would produce only light and no picture.

This TV electron-beam has an important difference to the lightning (which moves from e.g. a negative charge to a positive charge in an electric field). Not only the screen but the whole vacuum-cone has the same maximal-voltage of +26000V. The electrons in TV are pushed into the vacuum-cone by the electron-gun. They are pulled only in the electron-gun along 50 mm but they fly without an electric field in the cone along 500-1000mm! This push and the electrostatic repulsion among electrons do not produce an electrostatic explosion; the pinch effect holds these electrons together in the cone. Surprisingly, the last diaphragm of +26000V is in the entry of the cone; it has a diameter of only 3 mm. This hole is the site of the push. The electrons fly through this small hole but the pinch-effect (Fig. 3) holds the electrons together so strongly that they cannot fly to this diaphragm of the maximal positive voltage! Without the pinch-effect, all electrons would fly to this last electrode and the screen would remain dark.

Also the positive electric fountains of Enceladus are **repulsed** by the "positive carpet" into the neutral space without a negative pole, **formed by the pinch-effect to a fountain** (Fig.3). The particles fly parallel to each other without collision in this fountain (Fig. 3-4c).

The escaped electrons **cannot attract** these positive particles, because they are far away and in a tangential (antisolar-) direction and not in a perpendicular direction.

The fountains remain thin even in an altitude of hundreds of kilometres. Also in these high altitudes, the pinch-effect makes the fountain similar to a flow in an invisible pipe (also in Fig. 4c) as soon as one positive particle is pushed into the fountain by the "positive carpet", another positive particle moves upward at the end of the fountain. This ejection-model via electric repulsion and the pinch-effect can be used for the explanation of the filaments of the impacted meteor of Temple 1 and of many other bodies.

Both forces of infinite radius produce filaments:		
Attraction via gravity (e.g. at accretion disc)	Attraction via electric force + pinch-effect (e.g. electron furnaces, electron-welding)	Repulsion via electric force + pinch-effect (e.g. lunar ray craters, Enceladus-fountains, sputter)

Table 1. A black hole produces filaments of irregular cross section but jets of circular cross section. The hot spot of the welding machine is exactly circular, and also the fountains of Enceladus should have exact circular cross section due to their velocity and electric charge.

Some long fountains (left above in Fig.1) form pairs due to the fact that they are positive parallel currents which attract each other. However, they do not unify due to their electrostatic repulsion (white and straight arrows in opposite directions in Fig.3).

LABORATORY MODEL OF ELECTRIC FOUNTAINS - A NEW STATE OF MATTER

Prof. H. Jaeger and his team in University of Chicago elaborated the following model in which electrified dust particles form filaments (Fig.4). The dust was ionized by friction (similar to that in the Sahara?) and not by solar photons as at Enceladus. Dust-particles probably fly parallel to each other shaped by the pinch effect (Fig. 3) also in this case i.e. the e.g. positive dust particles repulse each other, but their motion upward (Fig.1 and 4) represents an electric current. Parallel electric currents attract each other and form a filament of circular cross section. The normal zigzag-motion of excited particles is not present here but an electrically given parallel motion of particles. "Inside the jet there is very, very little random motion" Jaeger said [5]. **An important meteor** can fly in a crash-curse to Earth. Its deviation is perhaps possible by the controlled reaction-force of these dust fountains (Fig.1).
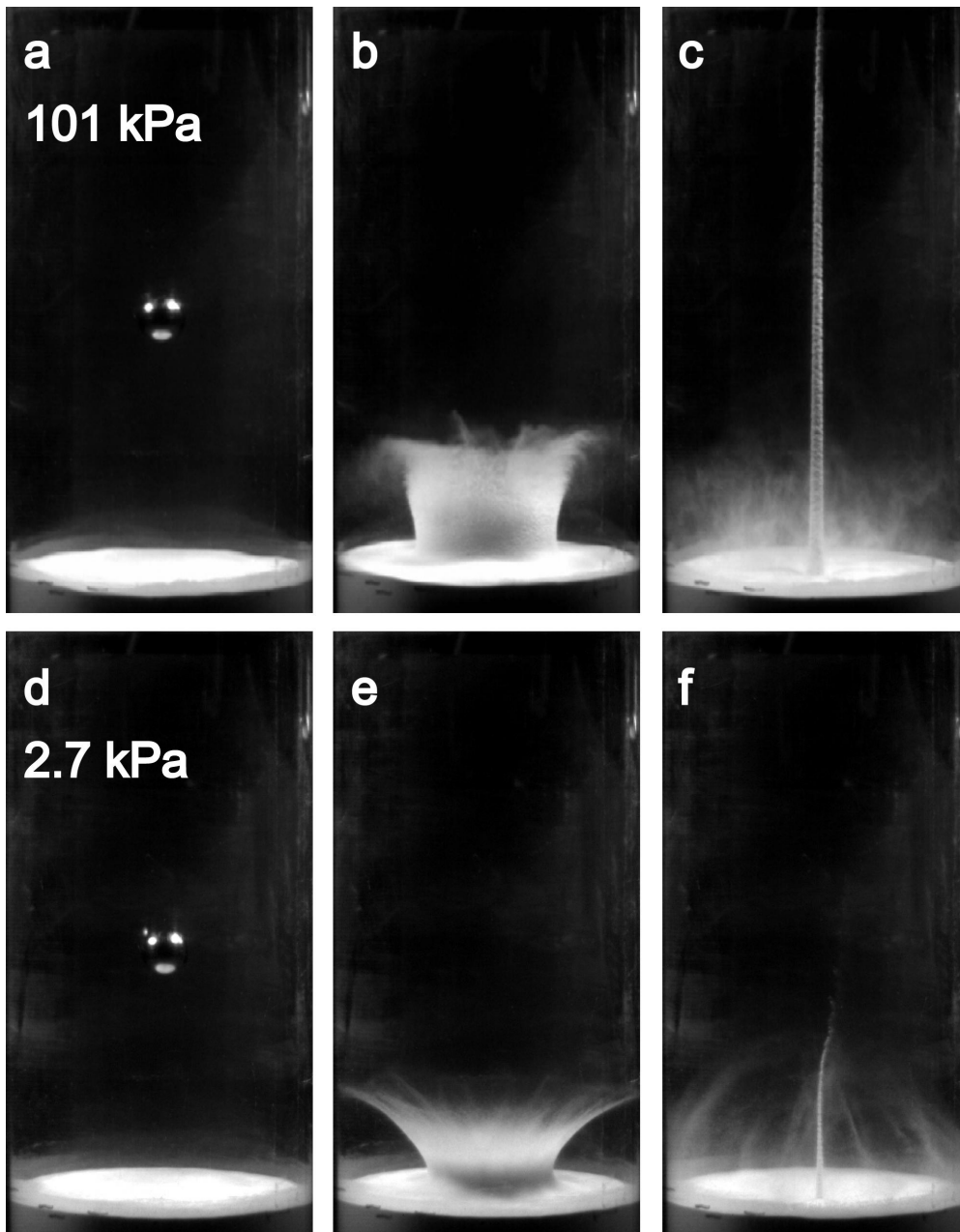
Fig. 4 electric dust-fountains as those of Enceladus but in laboratory (Fig.3)!

Frame a: a marble sphere is illuminated by 4 reflectors. It is falling into the dust (white).

Frame b: a large ring-crater and friction-electricity comes into existence after the impact. Fine filaments
emerge without order in lack of enough electricity. Air was a buffer among the particles.

Frame c: the elastic air keeps the motion-energy and a fantastic tall and elastic electric fountain with
standing waves comes into existence. The dust grains are electrically charged and fly parallel
to each other via pinch-effect. They do not collide with each other. Oscillating dust is ejected
from below with acceleration! The quicker flight above causes a higher electric current above
and a stronger pinch-effect i.e. the fountain is thinner at higher altitudes.

Frame d: (as "a" above) sphere is falling at low air-pressure. Air cannot buffer, but the dust is strongly
electrified because each dust crystal strongly scratches the other one (without elastic air).

Frame e: More heat-energy was produced than above (at "b"), but the about 12-16 short electric dust
fountains are perfect! Neighbour-filaments strongly attract each other as parallel electric
currents and form a beautiful collar. The form of this collar is still not clear.

Frame f: High electric charge forms perfect filaments but all are weaker than those in frame "c" due to
the lost mechanical energy. The standing waves of the central filament are still observable.
The fountains on the edge are attracted by the central one as parallel electric currents.

In this newly discovered and non-thermal state of matter [3&5], the usual thermal laws are not present. For example, in Fig. 1, the 9 fountains lay in a plain, because their mutual attraction would pull back a deviated fountain (similar to that in Fig. 4e). In Fig.1, the same is valid for the flight of the positive particles (black dots with white "+" in Fig.3). These particles fly parallel to each other in a straight line. They look for order (Fig.4e) and not for disorder. The distance between two neighbour-fountains is almost the same at their start and equal to their diameter because their mutual electric repulsion would be higher at smaller distances and the magnetic attraction stronger at larger distances. This rule is probably valid also in the laboratory-test (Fig.4). A calculation of this distance is still missing.

The **Coriolis-force** does not bend the 9 fountains because their particles are electro-magnetically accelerated by the fountain. All fountains act as solid elastic bodies (Fig. 3-4c).

Another important support of this electric fountain model is the zero charge balance. If a knocked-out electron returns to the surface, this re-neutralized particle does not fly away with the fountain. However, if this electron flies away with escape velocity, Enceladus loses this negative charge for ever. Enceladus will not be charged infinitely in positive direction due to its lost electrons, because the positive particle also fly out in one of the fountains and this particle with its positive charge also does not return. This zero balance suggests that the fountains in Fig.1 are much longer than a photo can show. The incredible lengths of the fountains confirm again the electric model. This balance is not clear in the test above (Fig.4).

The fountains probably become longer only some hours after a stronger solar activity (Fig.2) because the stronger photons ionize the positive carpets and fountain-particles stronger. It is easy to test during our solar minimum which has unusual strong flares.

These electric fountains reach high altitudes. The cause of it is that particles do not collide in space in their flight. All particles in flight are positive and repulse each other. This flight of charged particles automatically inhibits collision i.e. these positive currents attract each other stronger magnetically if the distance is too high but they repulse each other stronger electrically if the distance of the particles is too low (Fig.3). A strong support of this electric model seems to be this high altitude which would be impossible in the case of collisions in Fig.1 and Fig. 4. Also the observation proves that Fig. 1 does not show turbulences even between two neighbour-fountains. Particles fly parallel to each other without zigzag-motion (Fig.3). (However, normal thermal motion exists in each grain.)

Some particles of the fountains can be neutralized by vagabonding electrons. These neutral particles will fall back. They do not form fountains when falling back because neutral flows cannot have a pinch-effect. They keep the neutral charge balance of Enceladus.

PREDICTION

- The fountains of Enceladus should be elastic due to the electrostatic repulsion and to the pinch-effect. All fountains should oscillate axially (Fig.4 c) and radially..

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