19 July 2006

Dr Philip Campbell
Editor-in-Chief, *Nature*
4 Crinan Street
London N1 9XW

Dear Dr Campbell,

Energy from fusion – the unreachable star

There is now hard evidence to show that nuclear stability can drastically change in harsh environments, thus casting serious doubts, to say the least, on the very fundamentals of conventional high-energy fusion theory. It has, however, come as no surprise to my own research which also shows that fusion efficiency is not attainable in Earth space *even in principle*.

I am submitting herewith a paper on this crucial issue for publication in your esteemed journal. Do kindly include it in the Peer Review Trial server as well. The subject being of international concern also to the taxpaying public at large, the open web review could not have come at a better time for the paper's global reach and critique, which, I'm confident, will lead to its early acceptance.

Letters highlighting these fundamental problems were sent to many in the fusion community, including the seven EFDA Participant Team Leaders. The most unexpected, yet reassuring, response came from Princeton. In confidence here, Dr Ned Sauthoff, who is one of those seven leaders and also the US ITER Project Manager with many years experience at the DOE Princeton Plasma Physics Laboratory, was quite accommodative of my views in the many e-mails we exchanged on the subject. His last, dated 4 June 2006, in response to a query, was: "Thank you for your note. We in the US ITER Project Office have not ignored your concerns and the references you cited. I have sent the information to our chief scientist for his views and am awaiting his findings. Ned" Perhaps, Dr Sauthoff will not mind letting you in on those views and also being a referee to this paper.

A second referee I could suggest is Dr Duarte Borba, EFDA Head of Office and Associate Leader for JET, Culham Science Centre, Abingdon, UK. His response was also on behalf of Dr Jerome Pamela, EFDA Leader; and Dr Maurizio.Gasparotto, EFDA Associate Leader for Technology. The many e-mails that followed here, too, were most helpful to this paper even though Dr Borba maintained a defensive posture for the ITER project, unlike Dr Sauthoff who was neutral. (Although Drs Sauthoff and Borba may not be totally unbiased or free of all vested interests, they would still be second to none in commenting on the paper with authority for *your* impartial judgment.)

As the International Atomic Energy Agency put it on the disturbing empirical findings [Bosch, F. *et al*. *Phys. Rev. Lett.* **77**, 5190-5193 (1996); Jung, M. *et al*. *Phys. Rev. Lett.* **69**, 2164-2167 (1992)], "these factors have implications in nuclear structure as well as in astrophysics" (http://www-nds.iaea.org/reports-new/indc-reports/indc-nds/indc-nds-0399.pdf}. Not surprisingly, the detailed look into the workings of the atomic nucleus here shows also this obvious extension into the universe at large. The ramifications of the paper are thus truly and literally – cosmic; and the simplicity of it all, with illustrative figures, should be enthralling even the lay. Hope you will make an exception if you must to consider this submission favourably for the full peer review process. **Though the paper may now seem controversial, I can only say that in all sincerity the model I have presented here has the power to win over even the harshest of critics – but with the greatness of heart to *read it fully* and ask for any required clarifications.**

"But [Fred] Hoyle could, in essence, have been right: his only error was not to think on a grand enough scale. Our entire observable universe could be an 'oasis' in a grand ensemble of other universes. Although we cannot observe them (and they may be for ever inaccessible) other universes are a natural expectation from current cosmology. Moreover, many features of our universe that otherwise seem baffling fall into place once we recognise this."
"To appear so bright at such great distances, quasars would have to outshine entire galaxies even though they are energized by something smaller than our Solar System. They undergo outbursts, which are equivalent to turning on 10,000 galaxies like our own within a single day. How this happens is still poorly understood."

These are words of none other than Sir Martin Rees, Astronomer Royal, on pages 27 and 45 of his book, *Before the Beginning Our universe and others* (Simon & Schuster, UK, 1997). Through such writings of his, I found him not dogmatic at all about present day concepts. Perhaps, he, too, would be a good referee here to comment especially on the larger picture I have presented in Part 1 of the paper. (He may not know about me even though *Discover* had a feature on me and my work in their April 2002 issue – as a counterpoint, perhaps, to Prof Alan Guth's work on the cover story of that same issue!).

I am an engineering consultant by profession, having also worked for some leading UK- and US-based international project management consultancies in the past; I hold a Canadian passport.
Thank you and best regards.
Yours sincerely,
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Energy from fusion – the unreachable star

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In the macroscopic world of aviation research, man takes about sixty years to get from Kitty Hawk to the Sea of Tranquillity. He uses classical mechanics. In the submicroscopic world of high-energy fusion research, he also takes about sixty years... but with neither a viable machine nor one envisaged even for the next sixty years. He uses modern quantum mechanics. Do these not tell us that, perhaps, something fundamental is distorting our vision of the atomic world when viewed through today's quantum mechanics? Here, in this paper, the haze surrounding the submicroscopic world is dispersed; and the utter simplicity of its working and the extension of it into the depths of our macroscopic world are made all too patent. Sadly, in the process, we also see two insurmountable problems to face high-energy fusion sustainability: Multi-nucleonic nuclei, such as those of deuterium and tritium, become increasingly unstable with temperature rise; and net energy output requires an isotropic environment in absolute space, defined here as the space of the Cosmic Background Radiation (CBR), coupled with a rhythmic process of systematic fuel intake followed by product discharge.

Following the monumental 1939 work[1] of Hans Bethe, it is now presupposed that the Sun and stars are powered by nuclear fusion – the belief on which high-energy fusion research started in earnest worldwide[2, 3]. It was to harness this theorized power of stars for earthly use[4]. However, observations since 1939 have widened and deepened by leaps and bounds to also show our conventional wisdom on the nature of things to be generally in want. Typically, with all due respect to Bethe, one of the greatest thinkers of all time, consider the following two statements from Reference 1.

(a) “The production of neutrons in stars is likewise negligible.” This is now in serious doubt. With the discovery of the mysterious and unrelenting solar wind[5, 6] consisting mostly of protons and electrons, one could conclude these subatomic particles to be from the decay of copious neutrons; and a future investigation for the third decay product, the electron antineutrino, should confirm this final-stage nuclear disintegration that also effects the equally enigmatic solar corona[6, 7].

(b) “The heavier elements found in stars must therefore have existed already when the star was formed.” However, would not a common process for *all* stars irrespective of size – with galaxies, planets and moons, too, thrown in for good measure! – be more acceptable?

Further, the more relevant question of viability of high-energy fusion also comes sharply into focus to reveal but a simple answer. In total oblivion of which fact, trials are today ongoing globally in many a costly test reactor, with more countries expected to join in this rat race towards realizing what must now be deemed – the impossible dream. As such, the earlier we wake up to the reality that has now dawned, the better it would be for all concerned. (The funds and the invaluable human resources could then be usefully re-channelled without delay into other research fields of renewable energy.)

Part 1 of the dissertation here shows the macroscopic picture of the impracticability of high-energy fusion; and Part 2 addresses the submicroscopic problem of stability of multi-nucleonic fuel particles with rising temperature, which is more immediate to experimentalists today.

In the process, one should not be too surprised also to get a glimpse of the classical mechanical underpinnings of magnetism, among others, and even the seemingly unrelated phenomena of inertial resistance and inertial drive!

Part 1: Why is fusion energy not a viable proposition for us even in principle?

In the final perspective on the nature of things, we see our physical world of observation as finite for the simple reason our instruments of observation are finite in scope. (As the redshift of celestial bodies merges with the CBR, our world comes to its border.) Our universe is thus clearly part of a megauniverse[8, 9] (as will also transpire here), transcending human enquiry and thereby the scope of physics. However, redeemingly, we are able to piece together what we do observe of this universe of ours in order to understand the physics of it in full now[10]. The essential features of which final picture coming within the scope of this paper are:

The structure of the universe

Man, through his microscopes, perceives in the atom a semblance of his solar system. Through his telescopes, he also observes a likeness of that solar system in his galaxy; his galaxy as a miniaturization of the local spiral group of galaxies; and so on, as worlds within worlds within worlds...

And through his logical reasoning, which is but a consequence of that same natural order of things of his universe, it should not seem incongruous to the average human mind that our own locale of the cosmos, too, is yet another extended image of that lowly atom.

This cosmic region of ours, one among many in the observable universe, would thus have a proportionate central matter as ‘nucleus’ and layers of galaxy superclusters as ‘electron’ cover or shells. There is evidence in abundance today to support such a model; but it is in the form of a giant jigsaw puzzle in disarray. The pieces, nonetheless, are all there now; but the picture, the ultimate structure and form of the universe, is not that readily recognizable; it is even fuzzy to astrophysicists[11].

Here, let us fit all those pieces together systematically. The exercise, though, should seem but a high-school project in physics.

The latticework of the observable universe

Astronomical observations reveal the fact that the large star ends its active life in a spectacular supernova. The ejected matter from such exploding nuclear bodies then go to form a new generation of smaller stars. All these star types we are able to directly observe as discrete bodies in the firmament and thereby make these correct inferences (see, e.g., Reference 12).

It is also not inconceivable, therefore, that the large stars we see today were themselves once ejected from even larger nuclear entities – the galactic cores. But it is not possible even with the best of instruments to observe the galactic core directly to ascertain the process. Whereas the supernova debris eventually clears to reveal a core, the fog around the galactic centre never lifts. As a result, the nucleus of our own Milky Way Galaxy, for example, remains obscured at all time by the stars and the gas clouds of what we call the central bulge. This shroud never dissipates due to the virtually relentless stellar activity within, which feeds and sustains it. Nevertheless, recent endeavours have revealed to refined instruments and observational techniques[13] enough evidence to show that the region of the galactic core is indeed a hub of violent activity of *sustained* star formation[14].

Not so long ago, the central bulge was commonly thought to consist mostly of very old stars. But, now, there is also convincing evidence to suggest that star formation has been occurring near the centre of the bulge throughout the lifetime of the Galaxy. Thus, the most energetic of expulsions[15] from the galactic core are what we see mostly as stars and star clusters outside the bulge today[16].

Extrapolating back in time, a very close or contiguous union of such galactic cores (that is, in their extremely active and formative years) is what we observe, in time lapse now, as the quasar. Quasars and their ilk, collectively known as active galactic nuclei, or AGN, are the greatest cosmic powerhouses known today[17]. The AGN, in turn, would evolve from even larger and denser mass centres. The existence of such super centres, though, is not presently recognized, suspected, or even speculated.

Let us here refer to these ultimate mass centres, dispersed across observable space, simply as – "Cosmic Cores."

Due to the cover provided by the AGN outside, Cosmic Cores, too, remain out of direct view, like galactic cores. But here, too, indirectly, there is ample evidence to support such centres in our observable universe. For example, the Cosmic Cores would possess most of the mass in our universe (like atomic nuclei do in a body of matter); and it is only such extremely massive and compact bodies (in the foreground) that could possibly account for the otherwise enigmatic gravitational lensing of (distant) quasars[18].

But what would be the true function of Cosmic Cores?

To astronomers and astrophysicists, especially, the function of Cosmic Cores should not seem something that is at all new. Even this aspect of the cosmic process is seen today in miniature down the line.

We say that large stars die in the supernova and generate new stars. But the first part of this statement we also know is not generally true. That is to say, the remains of a so-called dead star would live again – for a repeat death performance another day – if the environment is right: The dense and extinct core, typically, a neutron star, exerts an enormous gravitational pull on all that is around in the vicinity and grows by accreting matter; in time, it would eject matter in a nova- or even a supernova-like event once again. In principle, therefore, there is no end to these epochs for the selfsame stellar core – if sufficient matter is (cyclically) provided. In the case of the Cosmic Cores dotting our universe, however – there just happens to be sufficient matter around, from an initial condition, to keep the process going indefinitely. (This critical initial condition relates to the more familiar triple point in physics today; the submicroscopic origin of which will be seen in Part 2.)

A Universe of Steady State

In actual fact, the Cores of the cosmic latticework feed each other. That is, they accrete matter, fuse them together, and toss them out at each other. Matter, from the galaxy supercluster to the atom, is thus continually recycled in our observable universe. And the cosmic species of the heavens continue to live on in their eternal splendour.

Evidence for this grandiose and cyclic mass transfer through cosmic space, too, is very well established now, though it remains a challenge to today's standard model: The periodicity of birth of galaxy cluster groups and the uniformity of their spacing and speed are truly breath-taking that they even make the observers to double-check their instruments in disbelief![19, 20].

It is thus plainly seen that galaxies are not scattered more or less randomly through space as had once seemed the case. Indeed, galaxies are aggregated as sheets of clusters and superclusters. It is like a cosmic foam where the walls of the bubbles are concentrations of galaxies. As a balance to these huge concentrations, immense voids also exist between sheets[21, 22].

Furthermore, as NASA's Hubble Space Telescope (HST) continues to confirm only too overwhelmingly, galaxies abound even at the deepest levels of observable space. Not only did the HST capture new galaxies in earlier "empty" space, but it also got a better look at some of the lumpy ones that had been seen before. Seen in the infrared, they look more like "normal" galaxies, like those in our own cosmic neighbourhood[23, 24]. Clearly, cosmic structures do not seem to have changed over time across observable space – as if in a steady-state universe.

The concept of the conservation of energy would also suggest a steady-state universe. Until only as recently as a decade ago it was difficult to reconcile all of the observed data to a steady-state universe. But, now, the powerful telescopes of the present day throw to us much more light than they receive. And, in this most revealing new light since the time of Bethe's theoretical insights, we see the awe-inspiring final picture emerging…

Every celestial body has a closed-loop trajectory beginning in a cosmic core and ending in a neighbouring one only to be regenerated, or, to be born again. And a steady-state universe would go on existing under the setting (as the perpetual-motion machine of some unknown Cause transcending our space and time and thereby even such logical reasoning).

The genesis of celestial bodies in summation

- The observable universe is an extension in three-dimensional space and one-dimensional time.
- This universe of ours is dotted with enormous nuclear centres, or Cosmic Cores, where fusion of matter prevails (Fig. 1 depicts one such centre).
- The extremely dense Cosmic Cores are akin to atomic nuclei in a stable yet vibrant solid medium.
- Mass-energy is continually exchanged (recycled) between Cores of the cosmic latticework in an unending saga of "little big bangs" and "little big crunches" at the cores (see also

Reference 25).

- We inhabit a relatively placid region surrounded by, but far removed from, Cosmic Cores. (We would not have evolved to the stage that we have in a region close to a Cosmic Core: The violence and the intensity of radiation would be far too great and the time scale far too small for most life forms, let alone for the current stage of their evolution.)
- Each Cosmic Core accretes matter – aging stars and galaxies[26, 27] – only to fuse it (in a slow crunch) and eject it out (in a hasty bang).
- The Cosmic Cores thus incessantly feed each other in a now observable steady-state universe.
- The highly fused ejectum from the core expands out in an arc as it speeds away from the centre at or above escape velocity. We see this early stage of cosmic evolution as a close group of quasars – the progenitor of the galaxy supercluster. (Even if it be outside our field of study, do we not *ever* wonder why galaxy clusters are periodic and fly in formation at mind-boggling speed – our Local Group, for instance, at six hundred kilometers per second, or more than a million miles per hour?! See, for instance, Reference 12, 19 or 28.)
- Quasars and their ilk are collectively known today as active galactic nuclei (AGN)[17]. These are the greatest nuclear reactors of all next to the Cosmic Cores. Detected today ever increasingly by modern instruments, AGN brilliantly dot enormous cloud complexes that are but the time images of incipient galaxy superclusters.
- The high speed of expulsion from the Cosmic Core takes the ejected nuclear matter into the thinning outer regions.
- In the speeding ejectum, each large lump, which is the quasar, splits into halves in succession.
- The process of bifurcation of the quasar goes on[29] until the fragments – individual galactic nuclei – come within the size limit determined by the regional field pressure the nuclear

lumps are engulfed in.

- The single quasar thus splits successively and evolves into the galaxy cluster. And the single Core ejectum, generally consisting of a group of quasars, transmutes as the galaxy supercluster[30, 31].
- The supercluster is thus a fast moving shell of matter expanding radially from its Core of origin. Distant superclusters will thus appear as perched on enormous bubble-like voids. [For a true picture of this cosmic foam, see, for instance, Reference 12, Figure 3.9; to which, author Peebles says on page 40: "The data were taken by Shane and Wirtanen (1967) at the Lick Observatory from a visual survey of photographic plates, as part of a larger sky survey that counted about one million galaxies." Figure 1 is a sketch of just one such bubble.]
- Being periodic exhalation-like emissions from the vibrant mother Core, the supercluster siblings will be equally spaced. The space between them will also be the most devoid of matter in the cosmos. (The sheer uniformity of these spacings observed today is even amazing to astrophysicists and remains a challenge to their standard model.)
- Bifurcations generally taper off for the AGN as the ambient field pressure levels off. In this vast mid region between Cosmic Cores, the galaxies stabilize, but the nuclear activities of individual galactic cores continue. Superclusters and clusters of galaxies are thus not cosmologically recent epochs as generally believed today[32].
- The Cosmic Cores form the reference ("rest") frame of the CBR[28] that we now detect. The space and time of the CBR can thus be considered, or even defined now, as the absolute space and the absolute time, respectively, of classical (Newtonian) mechanics; see, also page 54 of Reference 33.
- Veiled by the quasars outside, Cosmic Cores escape our direct observation. This is akin to the

galactic core being masked by the stars of the central bulge.

- Again, the single quasar, moving through the thinning region away from the Cosmic Core, successively bifurcates to form a group of galactic cores. The group of galactic cores goes to form – the galaxy cluster.
- Each galactic core, in turn, spews out matter periodically, spawning the stellar cores.
- Each of the larger stellar cores bifurcates successively to form – the star cluster. The last of these separations that fell just short of escape velocity are what we now see as binaries, ternaries, and so on, in the mature star cluster.
- In short: Stars are generally found in clusters; the star cluster transmutes from the (large) stellar core; stellar cores are derived from the galactic core; galaxies are generally found in clusters; the galaxy cluster transmutes from the quasar; quasars are generally found in clusters, or groups; the galaxy supercluster transmutes from the quasar group; and quasar groups are derived from the ultimate Cosmic Core.
- What worlds the latticework of Cosmic Cores extend into are beyond observation and, therefore, outside the scope of physics.
- Stars, therefore, are born primarily by fragmentation (and nuclear fissure) – and not by agglomeration (and nuclear fusion) as popularly believed today[34].
- Planets and moons are basically stars, or star fragments, that cooled off faster due to their small size. Their molten cores are thus nuclear where net *fissioning* of matter would continue to varying degree. (The young and molten planet could also beget its moons in early nova-like epochs.)
- We are today speeding away from the Cosmic Core of our birth (in a highly fused and low-entropy state) – at more than a million miles per hour through absolute space – towards the

Cosmic Core of our demise (in a highly fissioned and high-entropy state).

- And the cycle repeats.

In conclusion, nuclear fusion is the primary reaction only at the Cosmic Cores; and fission predominates the scene everywhere else down the line – in quasars, galaxies, stars, planets, and moons; the fundamental requirement for fusion efficiency being a systematic and rhythmic process of feed intake followed by product discharge in an isotropic environmental setting in absolute space, the space of the CBR. In our Galaxy where this isotropy suffers as a result of high absolute motion, energy from fusion becomes unsustainable even in principle.

Part 2: Why should the fuel isotopes become unstable with rising temperature?

Again, Mother Nature illustrates to us the simple reason why.

From Part 1, we now see a universe of steady-state eternally fuelled by nuclear fusion at the Cosmic Cores. What came before or brought about this state, let alone what caused it in the first place, is beyond observation and, therefore, outside the scope of physics. Confining ourselves, therefore, simply to physics, we see the Cosmic Cores to emerge in concert union (to the strains of Haydn's *Die Schöpfung*!) as the ultimate creator-cum-destroyer-cum-re-creator of all that they survey (except, of course, themselves!): Each Core ejects matter in the form of quasars; which, in turn, undergo fragmentation or nuclear fissure; and the final process down the line is the neutron decay that gives rise to the proton, the electron and the neutrino. The hydrogen that subsequently forms (as the orbital union of the proton and electron in cooler climes) is thus the ultimate exhaust of the cosmic process, and not its prime fuel as posited today.

Further, and briefly,

- Mass and energy are not only equal ($E = mc^2$) but the two classical concepts are also – fundamentally and inextricably – one and the same[10]. Let us call this singular concept: "Mass-Energy" (though we presently use the term little realizing its deeper and more profound significance now come to light).
- Hence, classical matter, basically, nucleons and electrons, are the condensed, or sub-c, form of mass-energy; and classical energy, basically, photons and neutrinos, the evaporated state, at escape velocity c. Our universe is thus a voidless and seamless continuum in mass-energy.
- Being beyond human enquiry, the two and only initial conditions assumed of the mass-energy continuum are: (i) a nonvanishing net asymmetry of movement, consisting of a linear momentum coupled with a spin (which handedness is most manifest in the right-handed nucleonic grain; the left-handed electron being a consequence of its evolution from the neutron); and (ii) a critical 'triple point' steady-state where evaporation of mass-energy from, and condensation of mass-energy into, nucleons and electrons are at statistical counterpoise.
- The atom is thus a vibrant and breathing entity: Each of its constituent nucleons and electrons breathes in mass-energy (net condensation) and breathes out an equal quantum (net evaporation) at steady state (Figs. 2 and 3); and every atom, from its outermost 'energy level' down to the centre of the nucleus, is maintained by the partial pressures of the outside 'vacuum' field, that is, by the incessant momentum (of mass-energy) exchanges at those various levels, making the classical concepts of nuclear forces unnecessary.
- The asymmetry renders the basic particles of matter, nucleons and electrons, as dipoles and their breathing anisotropic over the cycle. Thus, the ever-restless proton, typically, experiences a half cycle of net influx from the more intense ambient across its leading 'south' face, with resultant effect radially inward at the south pole, followed by a half cycle of net

efflux from the rarefying 'north', with resultant effect radially inward at the north pole.

- Under the efflux, the dipole lunges forward but is resisted by the intensifying vacuum mass-energy field in front; the body recoils back, imbibing mass-energy from across the front; a bow shock of vacuum mass-energy precedes the body carrying the momentum change (forward to backward recoil) of the body; and the cycle repeats (Figs 4 and 5). *And the (speed-c) bow shock that propagates through the vacuum field from the dipole is, basically, magnetic radiation.* (Mechanically impelled into motion from stars and galaxies, protons and electrons thus cause the cosmic magnetic fields[35]. Further, the breathing in and breathing out at the respective poles are complementary; one action cannot occur without the other in any given body, thus relegating the magnetic monopole[36] to science fiction.)
- For any body in general, the breathing frequency corresponds to the body's natural vibration; the cyclic forward lunge, described above, is *inertial drive* – one that keeps the thrown stone in motion; the resistance of the vacuum field across the front is the more familiar *inertial resistance*; the speed-c bow shock through the vacuum field is the now speculated *gravitational radiation* (that is, dissipating momentum from any body in general); acceleration (irrespective of cause, internal or external) results ultimately from net exhalation over the vibrational cycle; deceleration from net inhalation; and uniform motion when net exchange is zero; a body cannot attain speed c since it would cease to exist, being totally evaporated off; today, however, this is interpreted as the body increasing its 'inertial mass', and thereby its resistance to acceleration, to infinity[33].
- Speed being greatest along the equator of the spinning dipole, the equatorial girth is absolute and critically maintained over the breathing cycle (Figs. 6 and 7): The thrust of exhalation from one hemisphere coupled with the opposing reaction across the other tends to cause the

dipole to bulge at the equator, and a quantum around the equator attains speed c and evaporates off (simultaneously with the polar quantum); as the thrust relaxes over the following half cycle, equatorial inhalation takes place at the equator (again, in phase with the polar) to maintain the girth. And, basically, it is this equatorial exchanges that keep any electron in orbit around the proton – attracted over the half cycle of nuclear inhalation and yet kept at bay by the repulsive exhalation over the following half cycle; the phenomenon of electricity thus springs from this hitherto unrealized fact, making also Coulomb charges and forces fundamentally redundant.

- Irrespective of the dipole (nucleon or electron), the equatorial efflux waxes the body spin by $\hbar = h/2\pi$ and the influx drops it back to its nonzero seminal spin, giving the particle its statistical and characteristic half-spin, $\hbar/2$, over the cycle; fractional spins are detected only of those nuclear shrapnel, such as the so-called quarks, with lifetimes too short even to execute one breathing cycle in full before total evaporation; and in this final perspective, $\hbar = h/2\pi$ becomes derivable, for the first time ever, from first principles of classical mechanics[10]. Moreover, in principle, the equatorial quanta are neutrinos, only low in mass-energy; the polar and equatorial efflux quanta become most intense and detectable in the decaying neutron's final heave: the electron axially from the north and the electron antineutrino radially divergent from the equator, making the latter still difficult to detect due to its intensity dropping with distance.)
- In the atomic nucleus, or mass-energy liquid drop, nucleons are indistinguishable as protons and neutrons. In deuterium, for instance, the neutron is only indirectly identified as the grain, a right-handed eddy in the nuclear fluid, that is associated with a contiguous and countervailing surface quantum; and the other as the proton, an identical grain but associated

with a noncontiguous quantum (electron) in orbit in the 'neutral' atom.

- In the Earth frame, the free nucleon spontaneously orients itself in the direction of the frame's absolute motion. It is purely a mechanical, wind-sock type reaction for least resistance to breathing – intake across the front (south) and discharge at the rear (north).
- Under impelled motion, the free nucleon (or electron) would thus spontaneously move in the axial direction with advancing south; a spiraling motion ensues under encounters with other (like or unlike) particles.
- Any two contiguous ('touching') nuclear grains, as in the deuteron, tend to be axially side by side and antiparallel, again, a purely mechanical reaction for compatible rolling or spinning contact and stability. (Antiparallel axial union is not possible due to the repulsive efflux of both advancing faces; parallel axial union into a single eddy is not maintainable as a sub-c quantum with an absolute girth; and parallel axial union occurs only between a particle and its antiparticle, though it results in the mutual neutralization of spins and consequent evaporation of their mass-energy in toto.)

Hence, consider the basic multi-nucleonic nucleus, the deuteron, at rest in absolute space. In this ultimate ground state, the two constituent dipoles are mutually antiparallel along a common equatorial plane; and the natural tendency for each dipole to move in the direction of its own south, results in the two contiguous grains orbiting each other along their common axial plane, that is, with the common mass centre at rest (Fig. 8).

On the other hand, in the Earth frame, which is moving at approximately 370 km per second[12], or at 0.12% of the speed of light, in absolute space, this nuclear stability gets threatened: The ideal antiparallel alignment of the two dipoles is constantly strained as each tries to point its own south in the direction of absolute motion; with a particle velocity of v in Earth frame, the situation worsens when v is parallel with Earth velocity (antiparallel, though, is relief); and the higher this velocity v, the lower the stability of the deuteron drops, with total separation of dipoles at a critical velocity when their axes would become parallel and contact between dipoles totally “against the grain” (Fig. 9).

Unfortunately, in Earth space and in a medium of rising temperature, translated as increasing particle velocities, this dissociation into constituent nucleons is soon realized. The attendant rapid changes in direction will have the deuterons moving more frequently with the highest absolute velocities, with dissociation of those particles sporadically reaching top speeds. At a critically high temperature, dissociation peaks, when the mass-energy (or classical binding energy) absorbed in the dissociation process is excessive enough to cut the rising temperature and bring it down. With continued heating of the medium, a sawteeth type temperature profile (that is, of gradual rise and sudden drop) then ensues, a distressing and classically unexplainable observation that high-energy fusion experimentalists report[37, 38].

Therefore, the stability of deuterium, typically, is not what we have been assuming it to be to date. The argument holds even more for tritium since this isotope is prone to decay even under normal conditions. And relatively recent laboratory investigations on certain atomic nuclei[39, 40] tend only to heighten these concerns for *all* nuclei in general.

The new insight here would also explain why decay of the individual radioactive atom is classically not predictable with certainty – since the hitherto unknown absolute orientation in space is a key factor. With this generally changing as Earth rotates about its axis, orbits around the Sun, etc., only the half-period, or half-life[41], of a group of identical radioactive atoms becomes predictable in Earth labs, a consequence of the fact that, at all time, half of the atoms would be oriented in the general direction that makes them most prone to decay.

It may also be noted that, under near-zero temperatures, the mass centre of the free deuteron or deuterium would grind to a halt while the free proton or hydrogen would chug along indefinitely (Fig. 8); lower the temperature, more evident these contrasting behaviours of the two isotopes become. Both are today empirical facts[42]; the latter, though classically impossible, is termed the "tunneling" effect.

In final conclusion, net power generation from nuclear fusion is not even a theoretical possibility in Earth space. In other high-energy fusion experiments, it would augur well for success if nuclear properties of all particles of matter involved are first investigated for *extent* of stability, including changes to half-life periods, at the highest temperatures expected in the primary study. Although construction work on the €10-billion International Thermonuclear Experimental Reactor (ITER) has already begun in Cadarache, France[43], it would still be most unethical to ignore the disturbing empirical findings[39, 40, 44] and the International Atomic Energy Agency's report that followed[45]. Therefore, before proceeding any further, at least a verification of *what fraction* of the ITER fuel particles, deuterium and tritium, would survive to fusion temperature (of about a 100 million Celsius) should first be made[46, 47]. It would be for the proponents to convince and justify all concerned, the overwhelming majority of whom are – the lay and unwary public paying for it.

Nevertheless, the final goal of sustainability would always remain to us – the unreachable star, the Cosmic Core.

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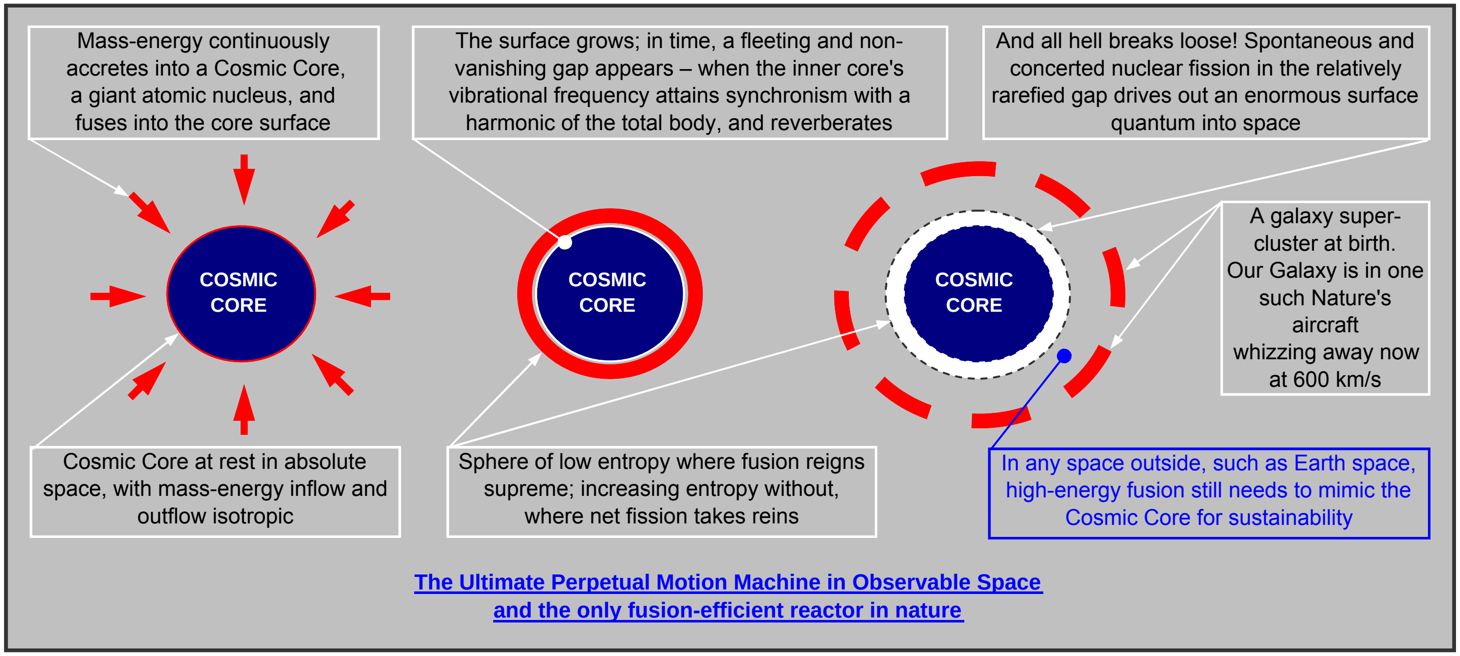

Figure 1 Cosmic Cores dot our universe, like atomic nuclei do in a solid yet vibrant medium. The exact mechanism here of accretion and ejection is, in principle, the same as that for the stellar supernova. The supercluster 'clouds' surrounding such cosmic centres would appear to us as a cosmic foam; see text for reference to a snapshot view of this foam in deep space.

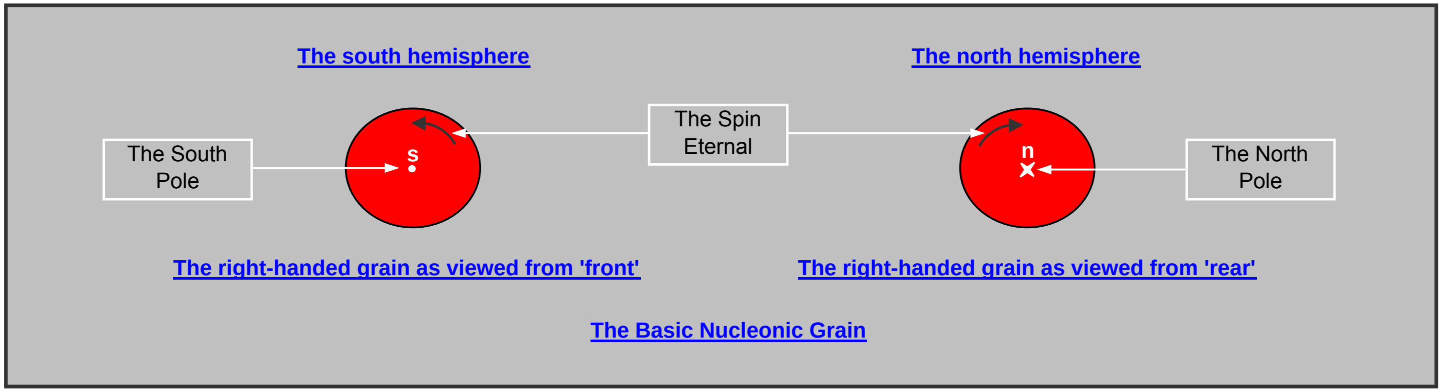

Figure 2 The basic nucleonic grain is right-handed, that is, with a nonvanishing linear motion coupled with a spin in a right-handed sense. Both wax from, and wane to, these nonzero seminal values over the exhalation and inhalation half cycles, respectively. See also Fig. 3.

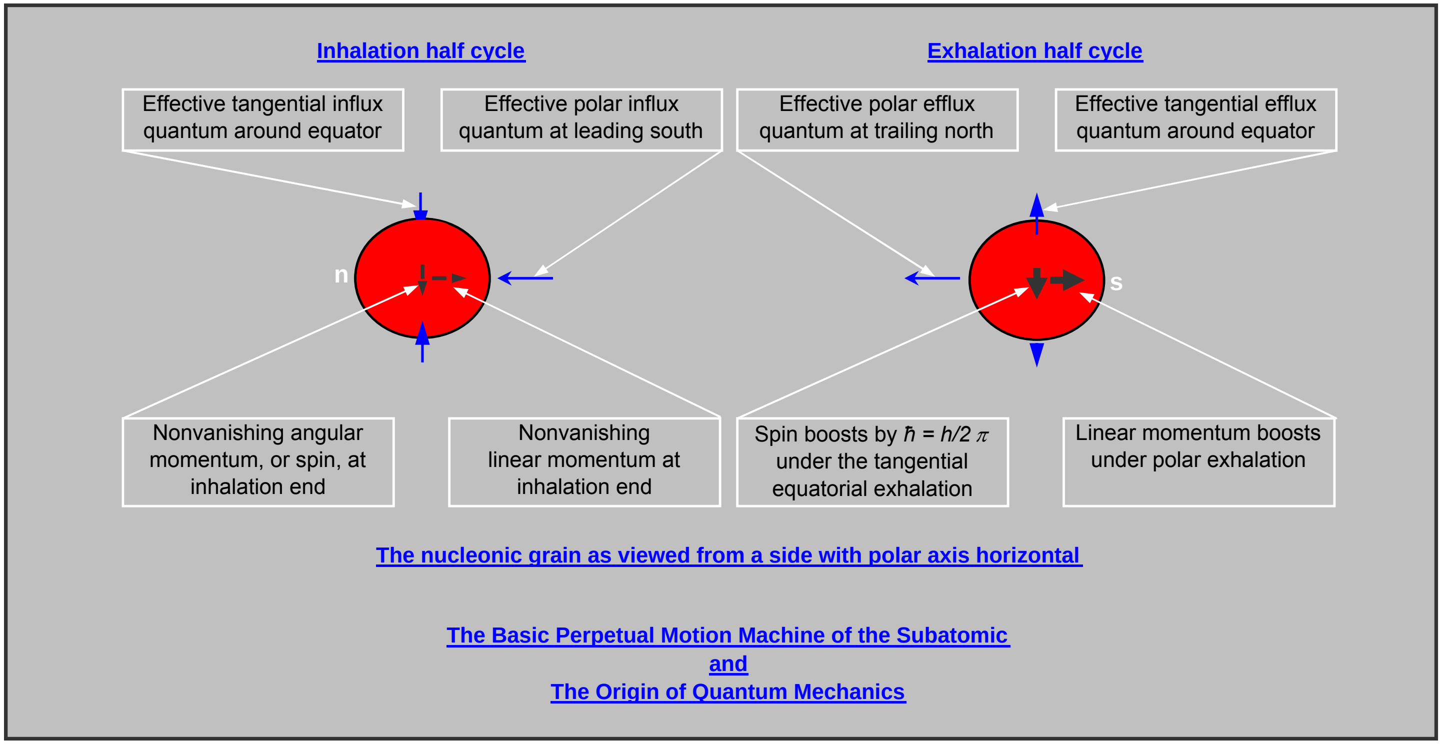

Figure 3 The nonzero seminal motions cause preferential net exchanges at the poles and along the equator; these, in turn, detectably cause a quantized spin and a quantized linear momentum (which wax and wane above the seminal values); the former gives rise to the (statistical) half-spin of the particle, while the latter is the basis of the (classically inexplicable) "tunnelling" effect. And so would spring quantum mechanics from the breathing of basic matter.

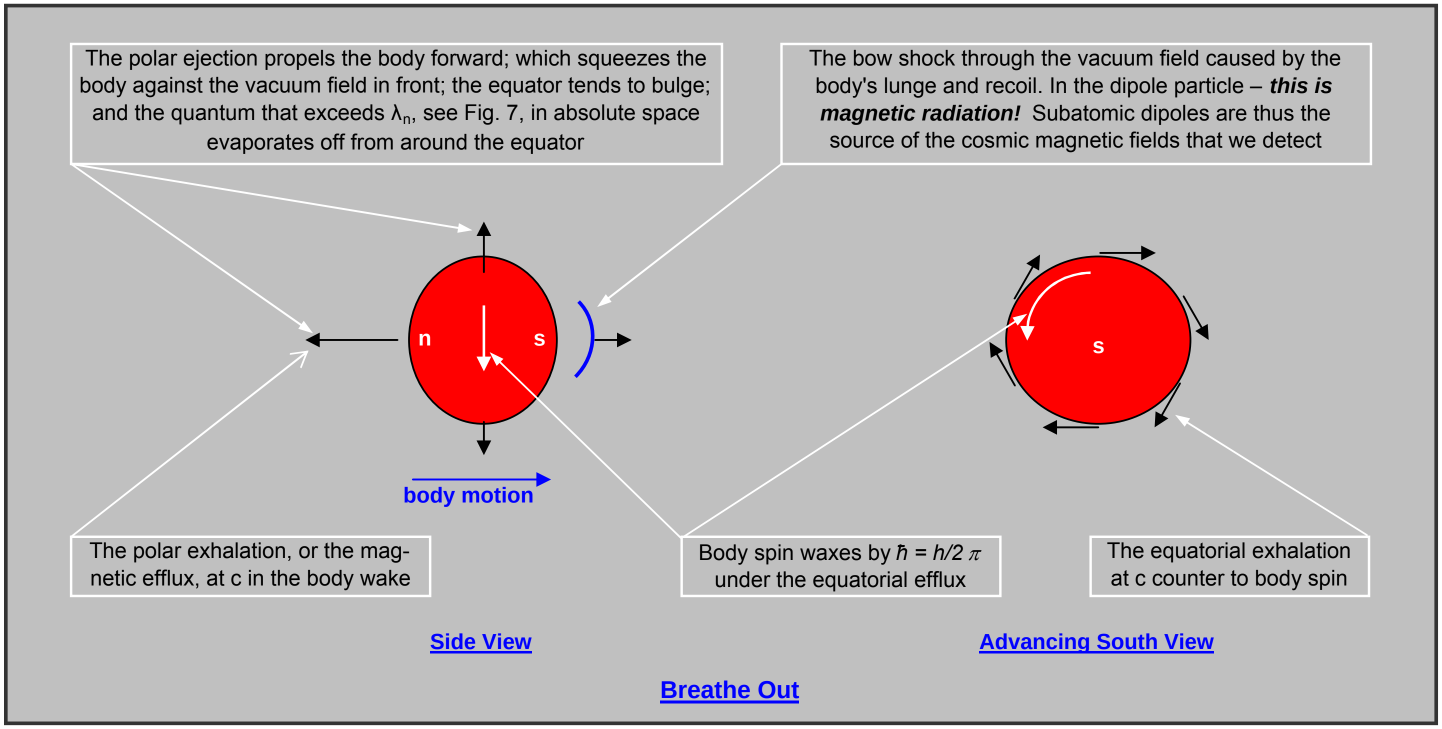

Figure 4 The acceleration of body, caused by exhalation at the rear, is opposed by the vacuum mass-energy field in front. ***And this, basically, is inertial resistance***. The dipole recoils back; and an intense wavefront, or bow shock, of vacuum field mass-energy moves forward – ***the magnetic radiation***, carrying with it the forward and backward recoil momenta of the body. Around the equator, a similar countervailing exhalation boosts the dipole spin to $\hbar = h/2\pi$ above its seminal value. The body has breathed out a net mass-energy quantum from the pole and another from around the equator. The stage is set for Fig. 5.

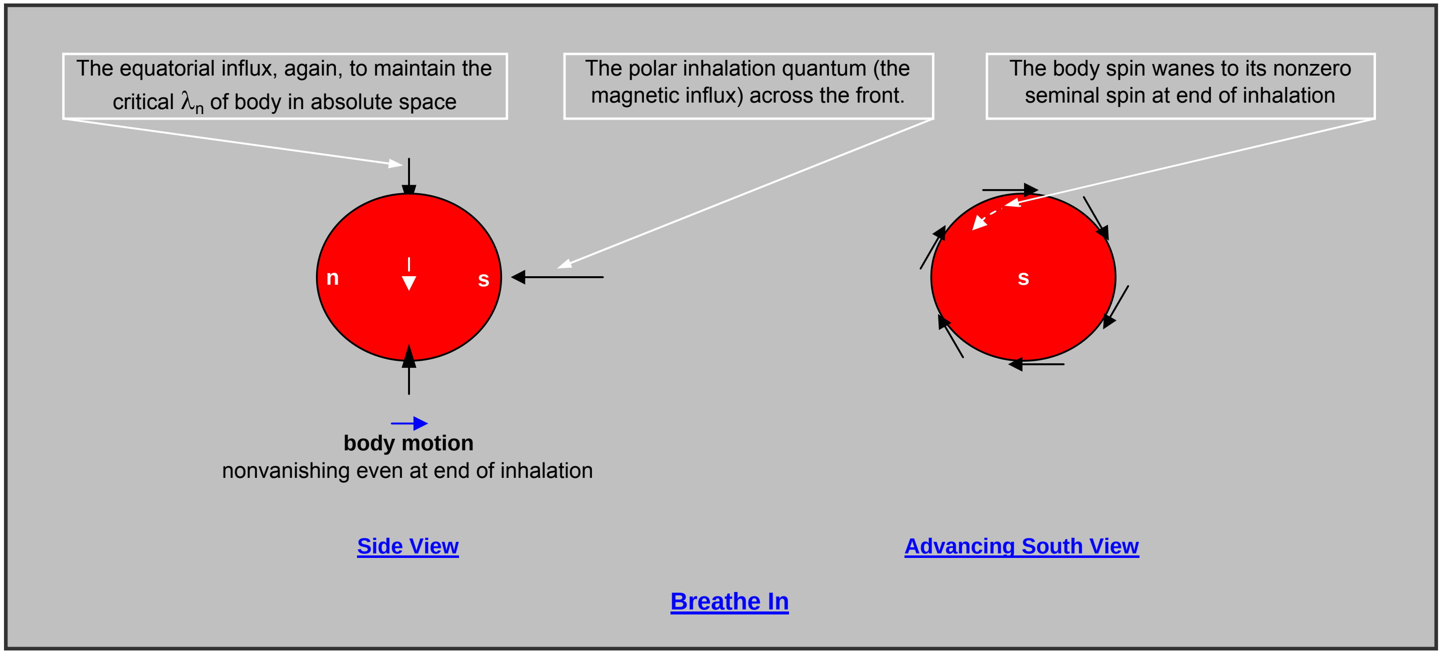

Figure 5 The inhalation of net mass-energy, across the leading south, slows the body down to its seminal motion, which deceleration is opposed by the vacuum mass-energy field at the rear. ***And this, basically, is inertial drive****, the one that also keeps the thrown stone in motion!* Around the equator, a similar countervailing inhalation reduces the body spin by $\hbar$, that is, to its seminal value, giving the particle a statistical and characteristic $\hbar/2$, or half-spin. The body has breathed in a net mass-energy quantum at the pole and another around the equator. And the cycle repeats (Fig. 4).

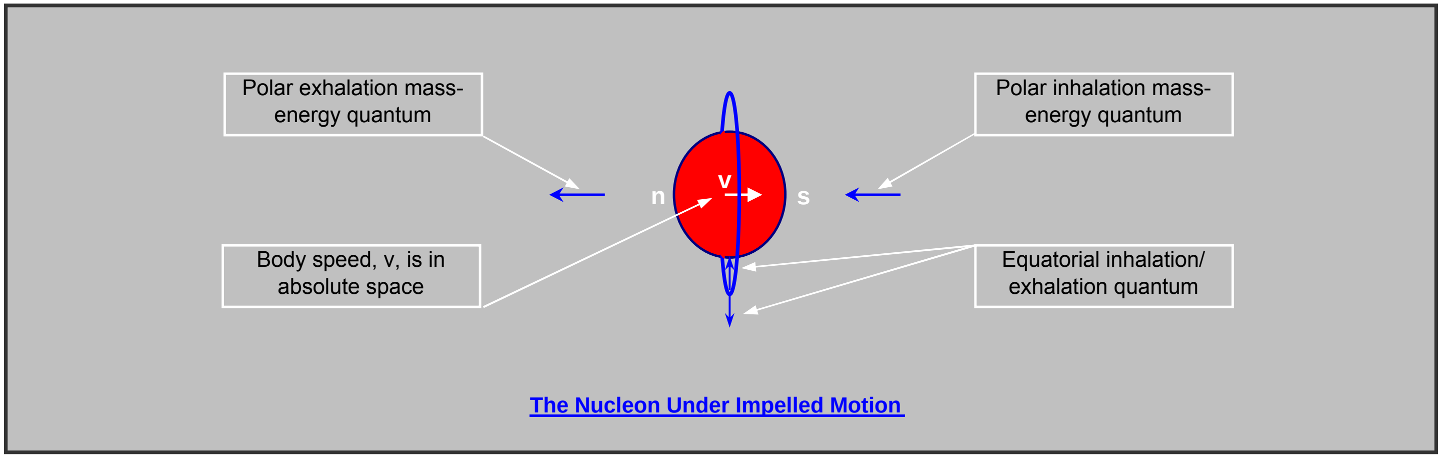

Figure 6 The Inhalation and exhalation of mass-energy take place all around the body. Shown in figures here are the effective net transfers over a typical cycle. It may be noted that under curvilinear or circular motion, the equatorial exchanges become lopsided; to maintain the absolute equatorial speed, more mass-energy is exhaled along the faster outer equator than along the inner half; this is the ultimate action (irrespective of cause, external or internal) that provides the body – ***the centripetal force*** for the curved motion; and the opposing reaction by the vacuum field to the centripetal acceleration is – ***the centrifugal force***.

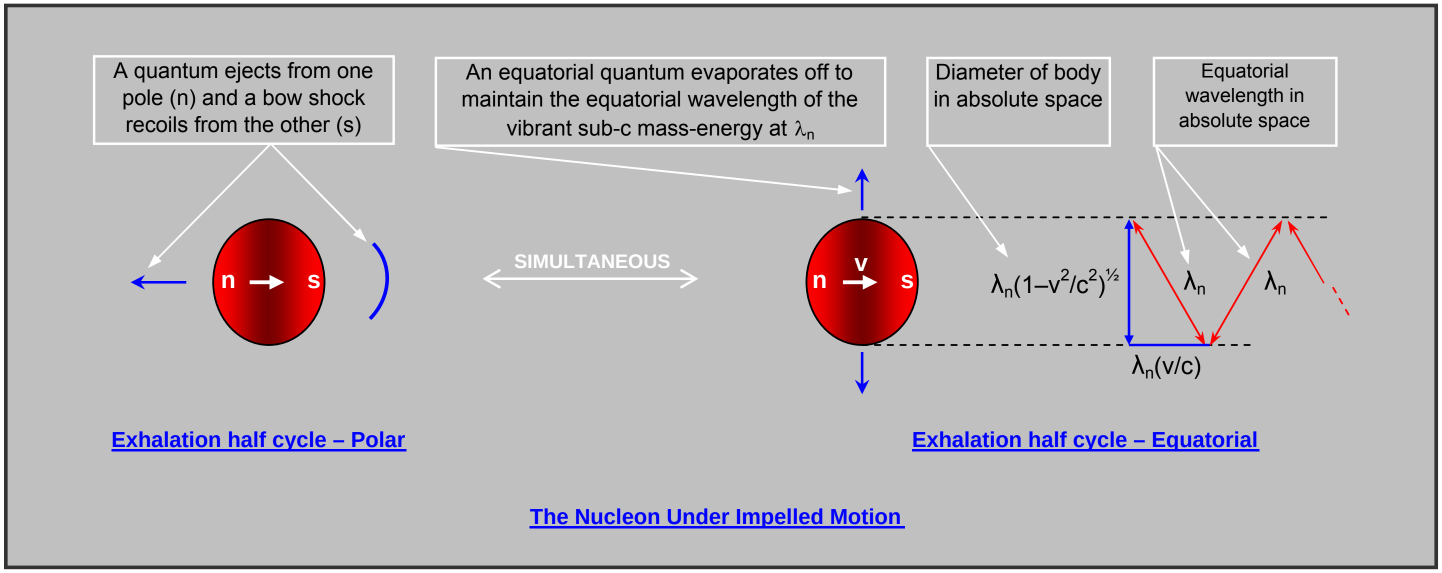

Figure 7 The nucleon has a maximum amplitude of vibration (beyond which mass-energy attains speed c and simply evaporates off the main body). Hence, the diameter, too, of the nucleon has an absolute maximum, say, λ_n (corresponding to this vibrational frequency of the body, or c/λ_n), that is, it is never exceeded by the body *in absolute space*. Motion being greatest along the equator due to spin and irrespective of body speed, v, the equatorial diameter would thus correspond always to λ_n in absolute space. Consequently, the moving body contracts not only longitudinally but also transversely, with implications, though, outside scope here.

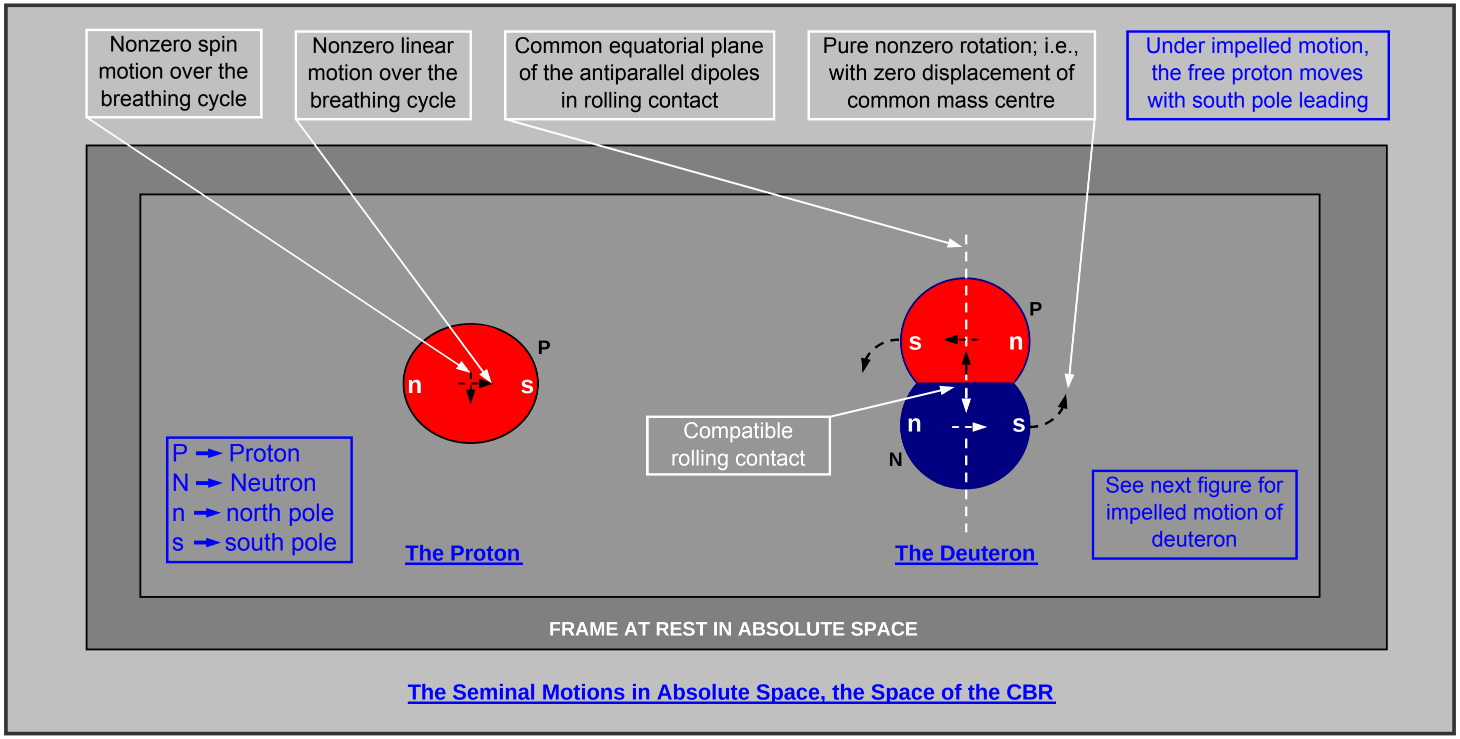

Figure 8 These are two typical perpetual motion machines of the submicroscopic realm. They show the basic reason why absolute zero temperature, when all body motions would completely cease, is never achievable in nature. There would always be that quivering of matter, absolutely.

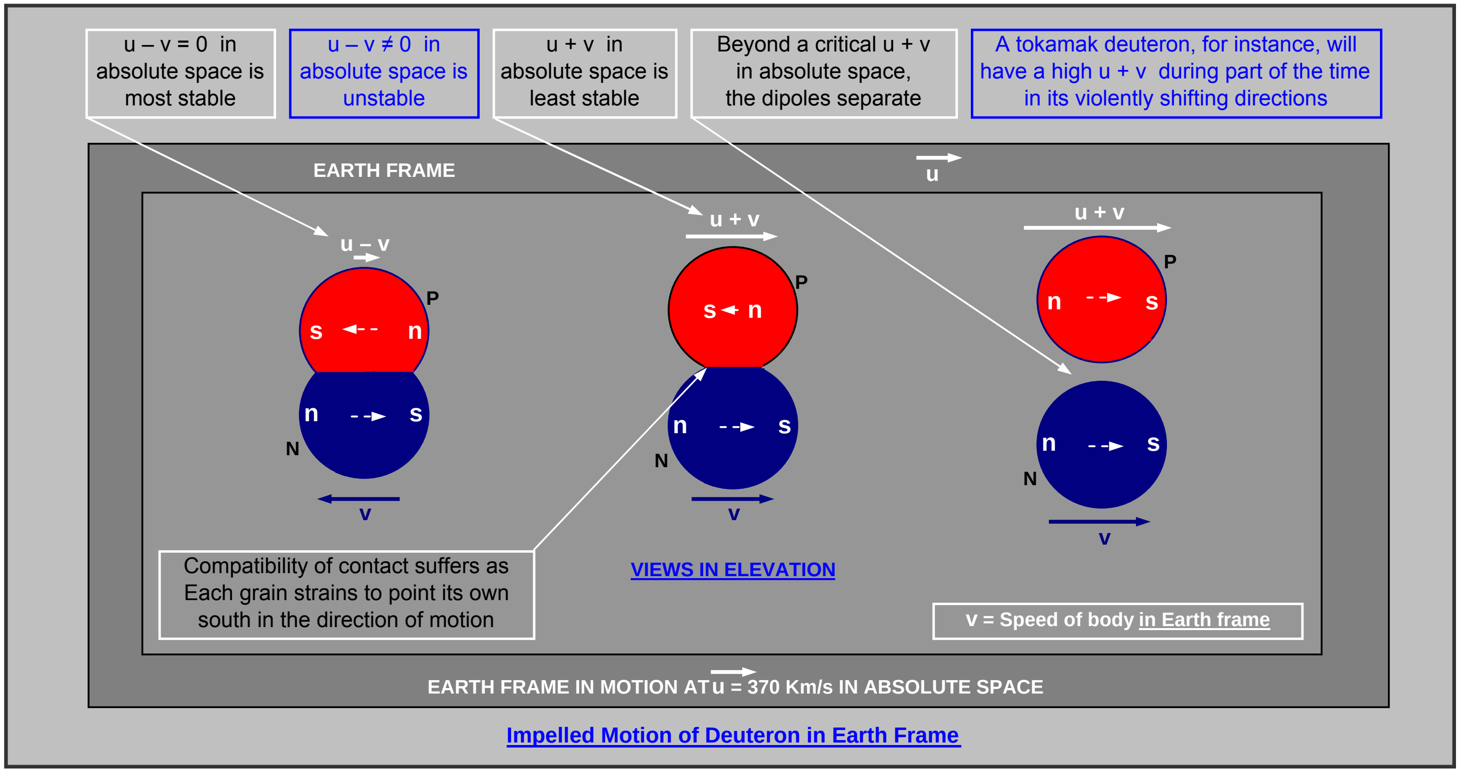

Figure 9 In a medium of, say, deuterons, statistically, half the number of particles at any instant will be moving in the general direction most prone to dissociation. With temperature rise, sporadic dissociations increase, that is, of those particles attaining the critical maximum speed in absolute space. Mass-energy (or classical binding energy) is absorbed in the dissociation process. At a critically high temperature, dissociation peaks, when the absorbed mass-energy is excessive enough to cut the rising temperature and bring it down. With continued heating of the medium, a temperature profile reminiscent of the sawtooth (that is, of gradual rise and sudden drop) then ensues.