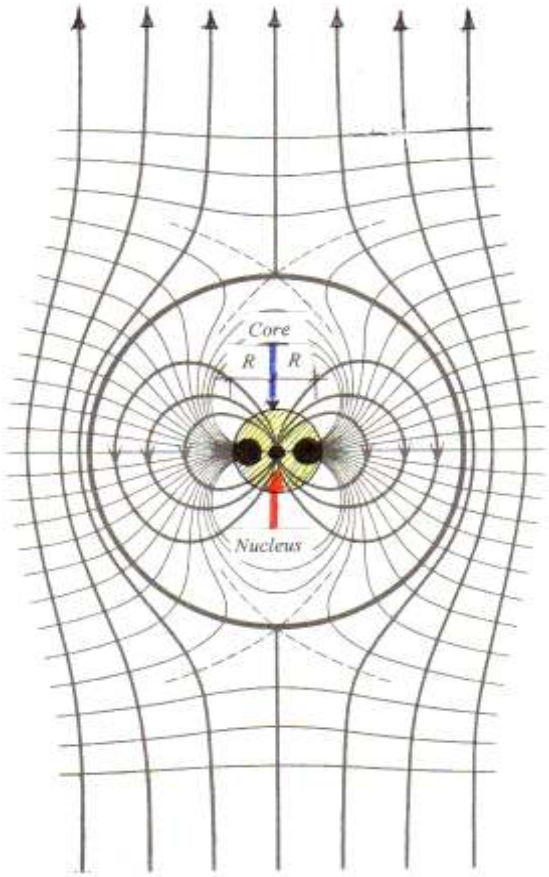
SECOND APPENDIX

CORE AND NUCLEUS OF A GRAVITATIONAL VORTEX - IS THERE A VISCOSITY OF THE PLENUM ? -



Schematic structure cross section of a gravitational vortex (immerged in a parallel flow of plenum)

1 – Structure of gravitational vortices and alleged viscosity of the plenum

In PART II of this essay basic hypotheses only have been formulated about the characteristics of the plenum, the main purpose being there to get soon at the point concerning gravitation.

Motions of the plenum and relevant propagation through the plenum itself have been analysed without accounting for any possible viscosity of the medium, upon the fundamental hypothesis that this quite special fluid does not possess mass. In physics, viscosity - and more precisely *dynamic viscosity* - is usually defined as a force (whose physical dimension is that of a mass multiplied by its acceleration), according to the following formula

[a1] $$w_d = \eta\, A\, \frac{dv}{dr}\ ,$$

in which w_d is the *force* (an internal friction) exerted by the fluid's dynamic viscosity, A is the contact unit-area of two adjacent layers subjected to the viscosity (friction) that is originated by the difference in the respective motion speeds; v is the fluid's speed that varies with distance r from the origin of the fluid's motion, and η is the ***coefficient*** *of dynamic viscosity*, whose physical dimension is

$[\eta] = [ML^{-1}T^{-1}]$. This coefficient is a constant proper to the fluid. Therefore, the *dynamic tension* existing between the two adjacent layers of fluid in relative laminar motion is given by the ratio

[a1'] $$\tau_d = \frac{w_d}{A} = \eta \frac{dv}{dr}.$$

Physics defines also a *kinetic viscosity,* which involves no force and can be obtained from **[a1]** after division by the fluid's density δ, to write

[a2] $$w = w_d/\delta = A\,\gamma \frac{dv}{dr}$$

whose physical dimension is $[w] = [L^4 T^{-2}]$, and where constant $\gamma = \eta/\delta$ represents the ***coefficient*** *of kinetic viscosity* of the fluid; the physical dimension of this constant is $[\gamma] = [L^2 T^{-1}]$. Thus, it is assumed that

[a2'] $$\tau = \frac{w}{A} = \gamma \frac{dv}{dr}$$

represents the *kinetic tension* existing between two adjacent fluid layers in relative laminar motion.

The definition of *kinetic viscosity* may be used to express the degree of kinetic cohesiveness that binds any layer of plenum in motion to the adjacent layers of fluid. The assumption is based on the consideration that whatever concept could be thought of as fit for replacing that of "mass", in addressing the plenum no such a concept is necessary to define the plenum's viscosity.

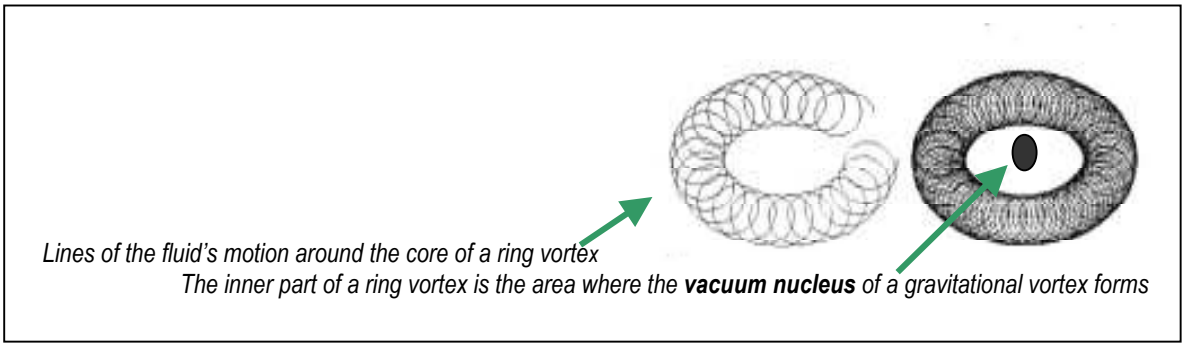
Upon the assumption that the ***coefficient*** *of kinetic viscosity* is a constant value that characterises the fluid plenum, Equations **[a2]** and **[a2']** show that the strength of both *kinetic viscosity* w and *kinetic tension* τ declines with the speed of the vortical stream.

Let's now analyse the implications of this definition of viscosity for the plenum's motion that characterises the ring/spherical vortex, as described in Part II, Paragraphs **5.3** and **5.4.**

With reference to the graph in the previous page, it's useful to add some lexical terms for better identifying distinct sections of the inner part of a spherical vortex.

The graph above represents a cross section of a spherical vortex, as it originates when an annular vortex (ring-vortex) is immersed in a stream of plenum that flows parallel to the axis orthogonal to the ring's plane (or vortex equator). The two round black spots represent a cross-section of the vacuum core (*true vacuum,* i.e., absence of plenum) of the ring-vortex, while the central smaller round spot is a symbolic image of the *true vacuum* ***nucleus*** of the vortex caused by the inner speediest rotation of the ring-vortex fluid.

One can conventionally define *"**core**"* of the vortex the sphere whose diameter is $2R$, which is the *external* diameter of the ring of *"true vacuum doughnut"* that forms the core of the ring-vortex.



With reference to the centre of a gravitational vortex, the speed of the fluid's stream transmitted through the plenum was previously expressed by $v = VR/r$, where V is the plenum's speed at the core's surface, R is the core's radius, and r is the distance from the vortex centre (see also Paragraph **2.3** and **2.4** in Part II).

However, allowing for the inner structure of the spherical vortex illustrated above, the plenum's speed distribution previously described by v must be viewed as a simplification. Actually, the plenum's speed distribution in a spherical vortex should more correctly be represented by the following formula

[a3] $$v = \frac{Vr_0}{r-(R-r_0)}$$

considering that the *source* of the fluid motion is at the surface of the " *vacuum doughnut* ", whose circular cross-section radius is here denoted by r_0 , which is obviously *smaller* than *R*.

The reason for the simplification previously adopted in the reference essay is quite reasonable, since the extent of both *R* and r_0 is negligible in determining the vortex gravitational field when *R* (let alone r_0) is compared to the gravity/gravitational distances that are usually involved by the analysis. For example, the estimate of $R = n_E$ =13.59 metres given by formula Formula **[III.21],** Part III, for the radius of the Earth's vortex core, is only 0.000002 of the Earth's radius at sea level. The simplification adopted in neglecting $R = n_E$ has actually no detectable consequence when the distance from the vortex centre is introduced in the gravitational equations [1] .

Nevertheless, in approaching the definition of the kinematical viscosity of the plenum, *R* and r_0 are no more negligible. By use of definition **[a3]**, the derivative of speed v with respect to the distance from the vortex centre is

[a4] $$\frac{dv}{dr} = -\frac{Vr_0}{(r-R+r_0)^2}.$$

By substitution in **[a2],** the kinetic viscosity of the plenum is expressed by

[a5] $$w = -\gamma\frac{AVr_0}{(r-D)^2}.$$

In this formula, $D = R - r_0$ is the radius of the circular axis of the "vacuum doughnut" of the vortex core.

The negative sign in the right hand side of Equation **[a5]** means that the "constraint", or "strength" ("*kinetic friction*") of kinetic viscosity w works in opposition to the fluid's stream, (i.e., in the direction opposite to that of speed *V*).

It is interesting to consider the case of $r = R$, i.e., of $R - D = r_0$, to substitute this in **[a5]** and express the plenum viscosity between the first two layers of fluid around the vortex ring core**:**

[a6] $$w_0 = -\gamma\frac{AV}{r_0},$$

which is the maximum value – in absolute terms – of the vortex viscosity. From **[a6]** it is possible to express the vortex source speed *V* as a function of the plenum's maximum viscosity and of the "thickness" ($2r_0$) of the relevant "vacuum doughnut", **:**

[a7] $$V = -\frac{w_0 r_0}{\gamma A}.$$

[1] For example: the difference in weight that could be detected in any object at the ground floor of a house, with respect to the object weighed at the fourth floor of the same house, is comparable to the difference involved by neglecting $R = n_E$. The difference could approximately be represented by the weight of about 15 nucleons per kilogram of matter, while 1 kg of matter consists of about 4.24×10^{16} nucleons.

If, as it is reasonable to think, w_0 is a *constant maximum* for the plenum, whatever the vortex, then Equation **[a7]** indicates that the source speed V of the vortex, which is also the plenum's maximum speed in the vortex considered, is directly proportional to the "thickness" of the ring vacuum core.

Assuming that w_0 is a *constant maximum* for the plenum means also assuming (consider Equation **[a2']**) there is a *maximum kinetic tension* τ_0 expressed by

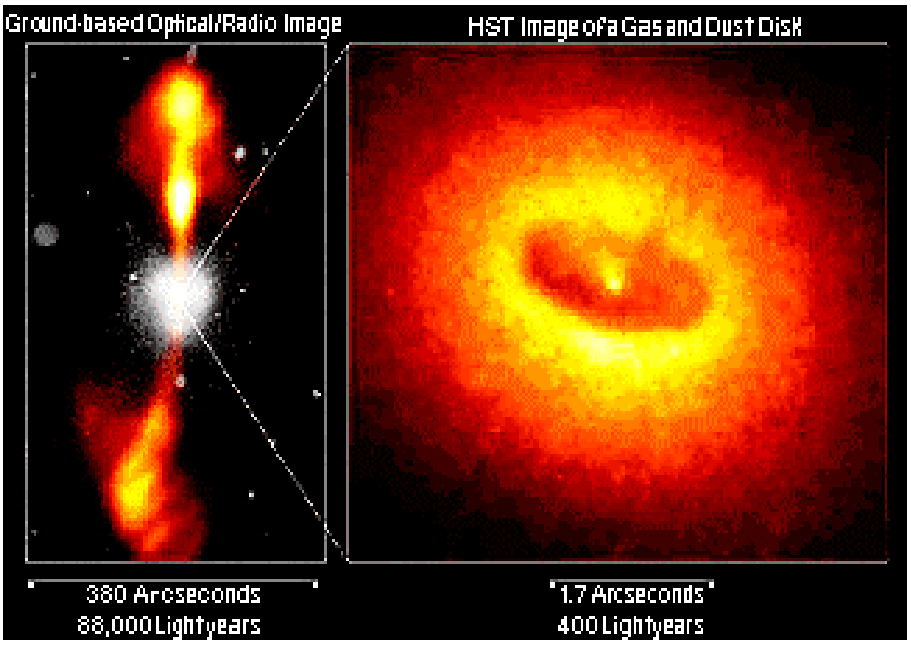
[a8] $$\tau_0 = \frac{w_0}{A}$$

beyond which the "strength" of viscosity w_0 cannot keep the continuity of the plenum's substance**:** the plenum can only break around a *vacuum core* and give origin to a closed vortex string, which may be either a ring-vortex or any other kind of vortex, as commented on in subsequent Paragraph ***2.***

The existence of a further *nucleus of nothingness* at the centre of the vortex depends on the particular distribution of the plenum's velocity around the core of the vortex ring**:** if there is a velocity component parallel to the axis of the ring-vortex, the opening of a laceration in the plenum is inevitable, with the associated formation of a nucleus of vacuum.

The described system of volumes of *true vacuum* constitutes the *bare mass* of the core of the gravitational vortex.

The photographs that follow, which have been taken by *Hubble Space Telescope*, seem a picture of what has just been described.

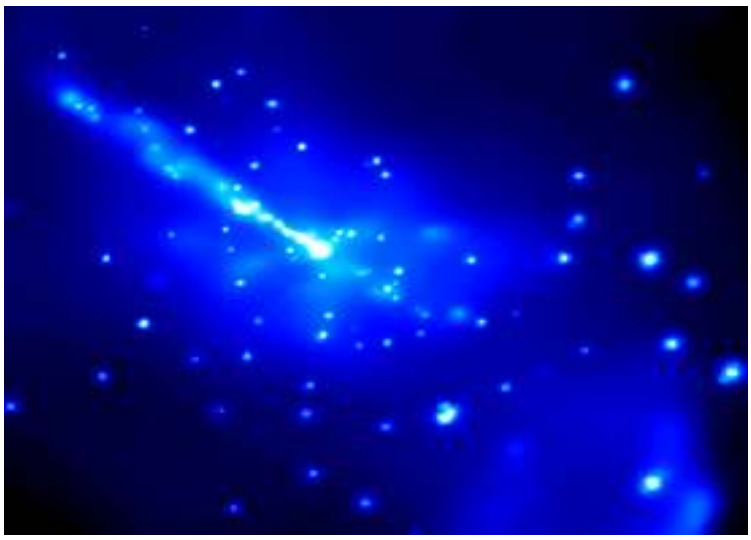


The *jet* expelled by the galaxy's core along the rotation axis of the galaxy's disk seems also a confirmation of the gravitational vortex structure. The ***nucleus*** of the vortex is a *real* black hole (i.e., a hole of nothingness in the plenum), and its volume, along with the volume of the vacuum core of the surrounding ring-vortex, might well be equivalent – inside a galaxy – to million times the mass of the Sun. According to a basic hypothesis made in this essay, the mass of matter consists substantially (and perhaps paradoxically) of the vacuum cores of its material particles.

In approaching the centre of the vortex, the fluid entering or getting out from each of the two poles does increasingly spiral, since it has orthogonal velocity vectors whose *vorticity* (i.e., the respective *curl* or *rotor* vector) tends to infinity in approaching either the poles or the "equatorial" plane of the vortex, as seen in Paragraph **5.4,** Part II, Equations **[32]** to **[35a]**. This leads to assume that the plenum's continuity, in the proximity of the vortex centre, *breaks* at a critical speed level to form a *hole of nothingness,* around which the fluid's spiralling speed achieves its maximum. Only by

hypothesis it is so far possible to assess the value of such a maximum speed. However, nothing opposes the idea that the plenum's speed around vacuum cores could exceed the speed of light. In fact, the speed of light may be the maximum speed *across* the plenum, but the speed of the plenum itself with respect to the absolute *true nothingness* might be higher or even much higher than the speed of light.

The spiralling motion of the plenum along the vortex rotation axis brings about the formation of electromagnetic fields whose frequency is closely related to the fluid's velocities involved. The inflow-outflow jet is also house to an extremely high turbulence, which could partly be described by the values of the *curl* vector of the velocity inside the flux, following an analysis of the same kind as the analysis made in Paragraph **5.5,** Part II, for a spherical surface of a gravitational vortex. The dense swarm of local discontinuities created by that turbulence in the plenum flux gives also rise, beside radiation, to the formation of very-high-energy particles.



Centaurus A Galaxy - X-ray image

The vortex structure, as schematised by the graph beneath the heading of this *Appendix*, should be the same - in a very ample range of scales - for all gravitational vortices, from the vortices of galaxies and galaxy clusters to the vortices that have generated stars, planets and (where applicable) satellites. It should not be too risky imagining also that the sources of cosmic rays are right the axial jets of gravitational vortices.

Centaurus A Galaxy – Visible effects of its core's activity (spiralling jet)

The "accretion disk" of galaxies, i.e., the characteristic disk of galactic materials, does actually form where the higher degree of the vortex turbulence stabilizes, as it happens in - or in proximity of the *equatorial* sections of the vortex, thus allowing both matter formation and gathering in orbital planes. Whereas the nature of the vortex *polar* jet turbulence does not favour (but does not prevent) the establishment of plane orbital trajectories for matter. One of the hypotheses expressed in this essay (see Part I & II) is that matter forms and agglomerates because of the turbulence and forces inherent in vortex gravitational fields, to mean that matter is an effect – not the cause – of gravity fields. [2]

Ring-shaped vortices may be sources of many different types of velocity fields. This makes it actually impossible - *a priori* and by mere analytical instruments – to figure out what may happen within any observed active galactic nucleus (AGN).

2 – Ring vortices and vortex knots

Vortex fluid-dynamics was already developed in the early years of the 20th century, especially concerning vortex rings, spherical and quasi-spherical vortices, with and without vacuum cores. However, aiming at the study of cosmological events also by means of fluid-dynamics theory, it seems now necessary to promote a further development of the analysis that concerns motions of continuous, incompressible and homogeneous fluids.

One can reasonably imagine that there is a vortex-ring that constitutes the core and the founding element of any structured galaxy; but there is so far no theoretical instrument for establishing with an acceptable degree of accuracy the way in which those galaxy cores do actually work. The distribution of the plenum's velocity around a vortex-ring may take a wide variety of configurations in association with a corresponding variety of fluid-dynamic effects.[3]

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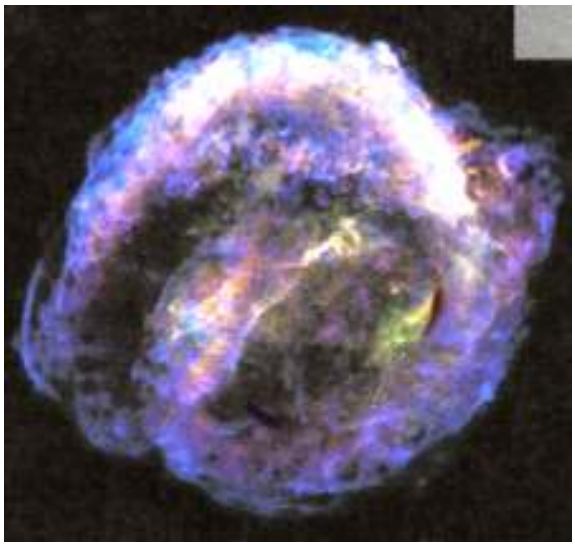
[2] Newton wrote he was rather sceptical as to the matter's intrinsic power to attract matter. Einstein, instead, postulated that masses deform the physical space around them so as to promote mutual attraction.

[3] As already remarked, one criterion to assess the maximum speed of the plenum around the vacuum core of a ring vortex is accounting for the "black-hole effect" associated with the vortex velocity field. Most probably, there must be a distance from the centre of the ring vortex core where the fluid stream rotates at the speed of light. This distance is the equivalent of the Schwarzshild radius for the black-holes. Let's now denote with V the fluid's speed at the surface of the ring's vacuum core. If we consider two components of velocity V, namely,

To make a few examples only, a vortex-ring may be thought of as formed only by the plenum's rotation around the ring's circular axis, with no translation of the fluid in parallel to the same axis**:** it is the example of the typical *fluid dipole*. Or else, in addition to the eddy about the circular axis, one may imagine many different translation motions along the ring's circular axis, with relevant different fluid-dynamic effects. Furthermore, from the theoretical standpoint, it is not possible to exclude the formation of *vortex knots*, in which the configuration of the vortex filament brings the surrounding velocity field to a prohibitive degree of complexity.

Scheme of a particular type of vortex-knots



Kepler's Supernova remnants

Vortex filaments are intrinsically stable only when they form closed knots. After possible collisions between two or more vortex rings, segments of broken vortex filaments may partly recompose in the form of knots. The theory shows that the vortex-ring is only the simplest shape in which a vortex filament can physically exist within an unlimited fluid space.

At cosmological scales, physics must account for phenomena that are much more complicated than those usually observed *in* and *from* terrestrial laboratories. The plenum can generate an

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one rotational component v_a around the ring's circular axis, and one translation component v_r orthogonal to the former and parallel to the ring's circular axis, we can write

$$V = (v_a^2 + v_r^2)^{1/2}.$$

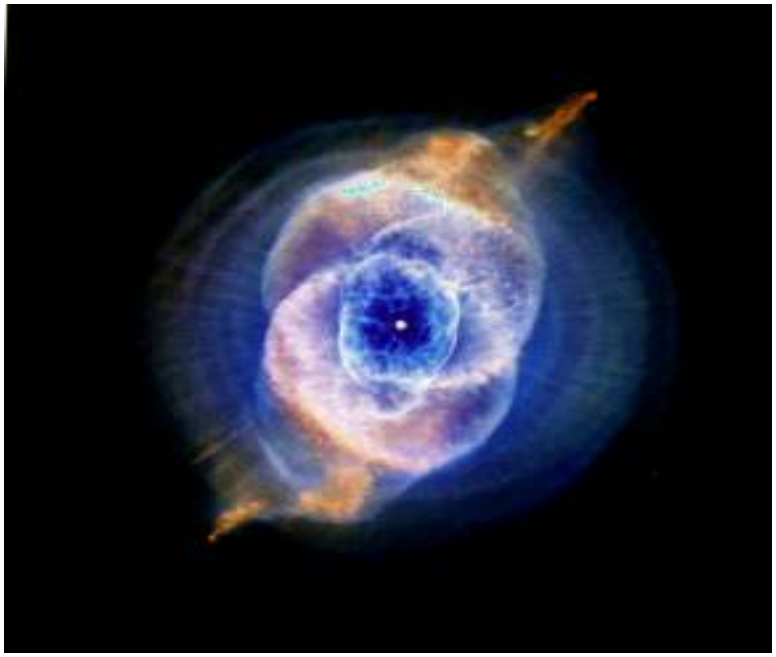
One possible distribution of the velocity in a ring vortex could make both v_a and v_r vary in each point of the surface of the ring's vacuum core, in order to have – for example - v_r component equal to V in the inner *circular intersection* of the ring's vacuum core *with the plane of the vortex ring*, while $v_r = 0$ in the external circular intersection. Such a distribution of velocity is expressed by the two following equations:

$$v_a^2 + v_r^2 = V^2$$

$$v_r^2 = V^2 [1 + \sin(\varphi - \pi/2)]^2$$

in which φ is the angle between radius ρ of the ring's vacuum cross section with the plane of the vortex circular axis. However, any other velocity distribution in which v_r is not nil *at the inner circular intersection* implies the formation of a nucleus of *true* vacuum around the centre of the ring.

unimaginable variety of velocity fields, most of which are impossible of both precise description and prediction.



The picture above, taken by Hubble Telescope, shows the so-called "Cat's Eye Nebula". No clear hypothesis can give a satisfactory explanation for this cosmic object. In the light of the theory outlined here, this nebula might be interpreted as the visible effects of a cosmic vortex-knot. [4]

Turbulence caused by the contact and interference between different flows, streams and oscillations of the plenum brings about unlimited ramified chains of "wrenches and lacerations" in the fluid continuum, thus creating gushes and swarms of vortices of any size and shape. These, with their loads of energy, collide violently with each other sparking around explosions of radiation and clots of matter. Such sequences of events are irreversible, and make it inadequate to describe cosmic processes with the conceptual paradigms of either Newtonian cosmology or general relativity or particle standard model. Moreover, it should be considered that the universe's *aging* has nothing to do with the geometrical *time* of physics.

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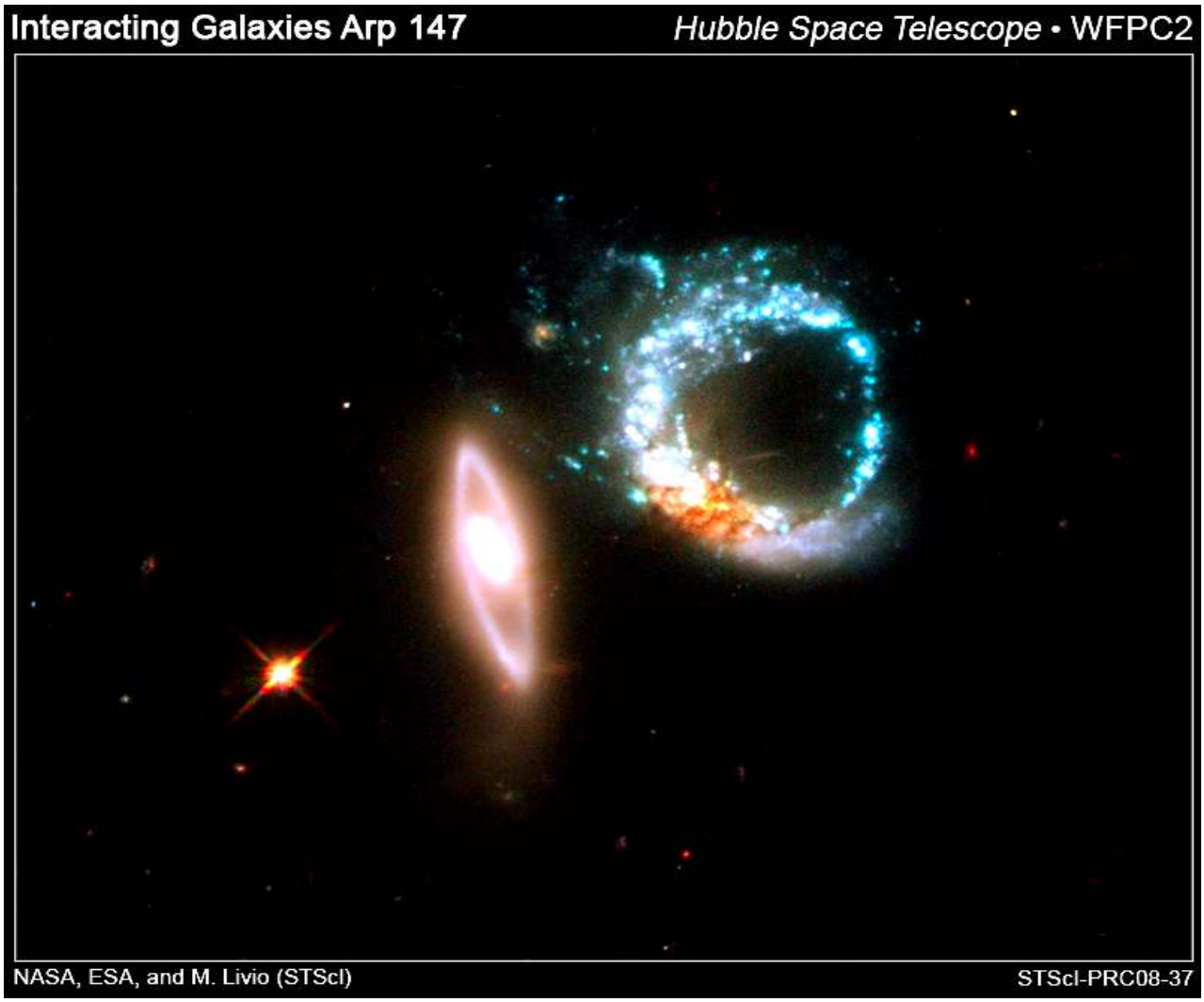
[4] Hubble Space Telescope has provided images of a large number of nebulae characterised by concentric "pulsating" rings, for which no reasonable explanation is so far available. However, the theory of vortex-rings could provide some interesting suggestions:

*"Let us suppose that we have two circular vortices having the same rectilinear axis. If the sense of the rotation is the same for both, the two rings will advance, on the whole, in the same direction. One effect of their mutual influence will be to increase the radius of the one in the front, and to contract the radius of the one in the rear. If the radius of the one in the front becomes larger than that of the one in the rear, the motion of the former ring will be retarded, and that of the latter accelerated. Hence if the conditions as to relative size and strength of the two rings be favourable, it may happen that the second ring will overtake and pass through the first. The parts played by the two rings will be then reversed; the one which is now in the rear will in turn overtake and pass through the other, and so on, the rings alternatively passing one through the other".**

See Horace Lamb, ***Hydrodynamics***, Dover Publication & Cambridge Un. Press, New York, 1945, Page 242.

* *Cf. Hicks,* <On the Mutual Threading of Vortex Rings>, *Proc. Roy. Soc.* A, iii, 111 (1922)

Cosmic processes appear like a continued shattering of equilibrium states, partly followed by states of *relative stability*, which are not at all equilibrium states, but actual or potential sources of further evolution phases. It is an unrestrained proliferation of creative chaos.



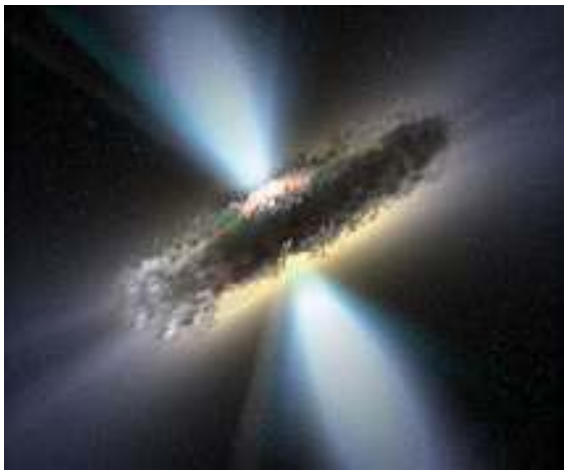
ARP 147 Galaxies portrayed by Hubble Space Telescope

The amazing image above, recently photographed by Hubble Space Telescope, provides a significant example of a galaxy formed by a huge ring-vortex, in a comparison with the "near" more common disk-galaxy that is visible beside.

Astronomers hypothesise that the disk-galaxy above had collided with another one of the same type, and that the large ring-galaxy is just the by-product of the collision.

In my view, there may be reason for doubting such an interpretation, despite the computerised "simulations" carried out to support the hypothesis. The simulations have used gas-dynamic models of which no clear indication describes the analogy between the dynamic structure of the models and the dynamic structure of the galaxies they simulate, also because – honestly speaking – the actual dynamic structure of disk galaxies is far from being clearly understood. Perhaps I am not the only one who questions similar simulations.

Beyond the major ring-galaxy, a "smaller" ring-galaxy seems visible in the photograph. As discussed in the preceding paragraphs, what Hubble Space Telescope has detected and portrayed beside the disk-galaxy might instead be *either* a couple of ring-vortexes, with relevant production of stars and matter (the existence of ring-galaxies might be quite unrelated with the collision or proximity of "normal" galaxies)**;** *or*, in an alternative, the unusual image of one of the two major galaxies might also be viewed as the in progress spontaneous formation of a huge unique galactic vortex-knot.



These other images show the shape of the *core* of either a star or a galaxy under formation. The ring vortex generates a very dense swarm of sub-vortices whose sizes range from sub-atomic to stellar dimensions. This is also the process of matter formation. The new matter gathers (accretion disk) both around the ring-vortex and around other sub-vortices of the system.

The vortex of "plenum" does also generate a "hole", approximately shaped like a very long spindle at the ring's centre, which is a real black-hole, i. e., a *nucleus void of physical space* (i.e., void of plenum), around which the "spiraling plenum" achieves its highest speeds. Such speeds can even be higher than the speed of light. It is a source of extremely high-energy photons and other particles.

The stable prevailing direction of this kind of axial jet of plenum is only one, like that of a propelling jet of fluid created by a turbo-engine.

There are other interpretations concerning the formation of the axial jets in galaxies and stars, as well as the opinion that an active galactic nucleus "shoots" *two* axial jets (or *flares*) along *two opposite directions*, as a consequence of an explosion. Instead, in my view, the ring-vortex works like a real turbine and propels itself across the plenum drawing space (plenum) from one side and ejecting it from the opposite side of the ring. The motion speed of the ring-vortex depends on the axial velocity-component of the plenum that spirals around the "rail axis".

Most of the galactic axial *flares* are not optically visible, and are only detectable as *X* and *γ radiation*. Once visualized, the length of these "flares" is amazing, much longer than the optical diameter of the respective galactic disk.

In my opinion, the length of the galactic axial "flares" provides an indication of the actual range of the galaxy's gravitational action. In other words, the *flares* or *jets* are an indication of the actual size of the galactic vortex as a whole, whose shape (be it visible or not) tends in all cases to be spherical. Yet, I deem that the axial flares of *X* and *γ* rays should also characterize the gravitational sphere of individual stars and planets, obviously according to various degrees of intensity of the jets, which must be considered as proportionate to the gravitational strength of the respective stars or planets.

3 – Decreasing propagation speed of the gravitational standing wave

The propagation of the vortex fluid motion across the plenum occurs through a particular standing wave, the propagation direction being orthogonal to the velocity of the plenum's stream**:** at each given distance from the vortex centre, the eddy's speed is constant with time, according to a

wave-period T that increases with the distance from the vortex motion's origin, so that a fixed wave amplitude λ is associated with each distance r from the vortex centre. Not to forget, such a standing wave is systematically transversal to its transmission direction because of the incompressibility of the medium.

The transmission speed u of a transverse wave across an incompressible fluid medium is usually expressed by**:**

[a9] $$u = \sqrt{\frac{\tau}{\delta}}$$

where τ is the *transverse stress* undergone by two adjacent layers of fluid in a relative laminar motion, and δ is the fluid's density. The transverse stress τ (as already seen with definition **[a1]**) is expressed by

[a10] $$\tau = \eta \frac{dv}{dr}$$

η being the *coefficient of dynamic viscosity* of the fluid, and v is the laminar speed of the stream, whose direction is orthogonal to distance r from the fluid motion's origin. Then, by substitution of τ in **[a9]** with the relevant definition **[a10],** the formula for wave transmission speed u becomes

[a11] $$u = \sqrt{\frac{\eta\ dv}{\delta\ dr}} = \sqrt{\gamma \frac{dv}{dr}}$$

in which $\gamma = \eta / \delta$ is the *coefficient of kinetic viscosity* of the plenum, as introduced by **[a2]** above.

As to the *propagation speed* of the stream motion (wave) in gravitational vortices, one can start from the above definition given for speed u. Thus, re-consider now (remembering Equation **[a4])** that

[a4] $$\frac{dv}{dr} = -\frac{r_0 V}{(r-D)^2} \quad ,$$

where $D = R - r_o$. Therefore, also remembering Equation **[a7]** for V, Equation **[a11]** becomes**:**

[a12] $$u = \sqrt{\frac{w_0 r_0^2}{A(r-D)^2}} = \frac{r_0}{(r-D)}\sqrt{\frac{w_0}{A}} = \frac{U\ r_0}{r-D}$$

where $U = \sqrt{w_0 / A}$ is a constant value for all vortices**;** radiuses r_o and D are instead constant quantities that pertain only to each vortex considered.

Equation **[a12]** shows that the propagation speed u of the vortex gravitational field is not a constant value, for it decreases with the distance from the vortex core, starting from an absolute maximum propagation speed U and following a decreasing rate directly proportional to that of the vortical eddy's speed v. In fact, an immediate implication of Equation **[a12]** is that at distance R from the vortex centre (i.e., when $R - D = r_0$), at the surface where the plenum "touches" the "vacuum doughnut", the initial *field propagation speed* is $u \equiv U$, which is therefore the absolute maximum propagation speed of a gravitational field, irrespective of the size of the vortex core. Beside that, it is easily proved that $u / v = U / V = constant.$

It seems worth drawing attention to the fact that the value of the field maximum propagation speed U is intrinsically different from that of the maximum source speed V at the surface of the core's "vacuum doughnut", since the vortex source speed V, as indicated by Equation **[a7]** (and allowing for preceding definition $U = \sqrt{w_0 / A}$), is expressed in its absolute value by

[a7'] $$\left| V \right| = \left| \frac{U^2 r_0}{\gamma} \right|.$$

Moreover, never to forget, velocity vectors $\vec{V}$ and $\vec{U}$ (as well as $\vec{v}$ and $\vec{u}$, obviously), are constantly orthogonal to each other.

In particular, formula **[a7']** indicates that the absolute value of the vortex *source speed* V exceeds that of the *wave maximum transmission speed* U for any value $r_0 > \gamma / U$.

If $\lambda = 2\pi r$ is the standing wave-length of a gravitational vortex, then (considering that $\lambda / T = u$) the gravitational wave frequency $\mu = 1/T$ is expressed by

[a13] $$\mu = \frac{1}{T} = \frac{u}{\lambda} = \frac{U\ r_0}{2\pi(r-D)r} \approx \frac{U\ r_0}{2\pi\ r^2}\ , \quad \text{when} \quad r >> D.$$

This means that the *gravitational standing-wave frequency* of a ring vortex decreases approximately with the square distance from the vortex centre.

It is clear that the preceding analysis and relevant conclusions make sense only upon the assumption that a *kinetic viscosity*, as per the definition **[a2]** given for w, can be attributed to the fluid plenum. Besides, the same conclusions should be considered as correct for any fluid dipole.

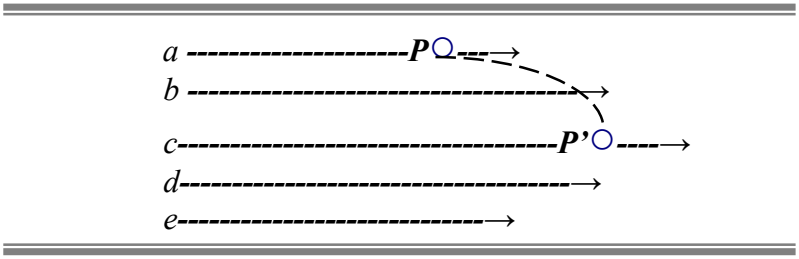
A question arises from the preceding analysis as to whether and how the conclusions formulated above applies also to the propagation of electromagnetic waves. In its simplest terms, the question is**:** can waves of light keep their speed and frequency constant in propagating - as it necessarily occurs - through gravitational fields?

A further comment**:** because of definition **[a8],** i.e., $\tau_0 = w_0 / A$**,** and $U = \sqrt{w_0 / A}$, it is $\tau_o = U^2$, so that $V = -\tau_o r_o / \gamma$**,** whence also $\tau_o = -\gamma V / r_o$**.** This implies that ratio V / r_o keeps constant in any ring vortex**:** the smaller the vortex the lower its source speed V. Should this conclusion be correct, the "quantification attempts" made in *Part III* should be revised accordingly and the constancy of the speed of light brought into question.

4 – Viscosity and state of a fluid field of velocities

It is worth pointing out that the *propagation* of the vortex gravitational wave **is in no case** the *transmission* of a force. The vortex wave is the transverse propagation of the fluid motion during the vortex formation. Once the vortex is formed, the relevant kinematical and gravitational field is *stationary***:** i. e., in every point of the vortex, at every fixed distance and position with respect to the vortex core, the velocity of the fluid plenum does not change. Consider the analogy with the parallel water flux in an artificial canal built in concrete. The edges of the canal exert their friction on the lapping water flow, thus slowing down the flow speed along the edge walls. The friction, through the water's viscosity, does partially propagate toward the central line of the water stream, where the flux is at its highest speed. Therefore, in the canal, the distribution of the flow velocity has a *gradient* that establishes a particular stationary state in the water flux.

Now, referring to the figure below



(which schematises the water flow in the canal), an ice ball dropped in *P* is "pushed-towards" or "attracted-in" *P'* where the flow speed is at its maximum, because of the velocity gradient that characterizes the water flux. The ice ball, once joined the thread line *c* of the stream, will continue its run along *c*. This fact does neither mean there is an attraction force inherent in thread line *c* and "transmitted" to the ice ball in *P,* nor there is a repulsive force inherent in the concrete edges of the canal that pushes the ice ball away. Actually, the velocity distribution of the water in the canal establishes a *stationary field of accelerations* (a particular *water space deformation*) that acts instantaneously on any object immersed in the stream according to fluid-dynamic laws.

The preceding remark gives an indication of the extent to which the concept of gravitational field outlined in this essay differs from various concepts of *quantized gravitation* proposed by several physicists and other researchers. In *quantum physics,* fields of force are identified in (or consist of) special particles that convey the force from one material particle to another material particle**:** as to gravity and gravitation, for example, the force conveyers should be "gravitons" or the like. No such gravity/gravitational conveyers have ever been detected though. That is why, according to the paradigm proposed here, the "gravitational interaction" *might seem to be instantaneous***;** but there is **no transmission of force, because there is no interaction between material particles.** The point, as already explained, is that gravitation depends on the *state* of the plenum, which involves and *constrains* any material particle.

5 – Antigravity by means of special electromagnetic waves

The ice ball in *P*, if endowed with a suitable water circulation around it, can oppose the push towards *P'***:** it would be a case strictly analogous to that illustrated by Figure 11 in *Part II* of this essay, Paragraph 5.7.2, in which the fluid circulation of the minor vortex counterbalances the effect of the circulation generated by the velocity field of the major vortex.

In general, as seen, the way to neutralise and oppose the centripetal acceleration undergone by any material body immersed in a vortex consists of suitably modifying the plenum's circulation around the body. To do so, one relatively simple way is suggested in Paragraph 7.1 of *Part II*, and schematically illustrated there by Figure 18.

An alternative way to resist and control gravity forces might be thought of as implemented through a particular use of electromagnetic waves. The suggestion comes both from the way in which electromagnetic waves have been described in *Part II*, Paragraphs 3.4 - 3.5, and from the explanation given in *Part III* for the deflection of light caused by gravitational vortices (see there Paragraphs 4 and 5 with relative figures).

For instance, let's imagine an electromagnetic wave that propagates across the plenum's stream of a gravitational vortex, the wave propagation direction being orthogonal to the direction of the gravitational stream. The transverse electromagnetic oscillation path, which is parallel to the stream direction, is on the one side shortened and on the other side lengthened by the constraint to follow *also* the local thread of the vortex. This means that the wave amplitude is deformed in the direction of the stream's velocity, and this is true to the extent to which the wave amplitude is formed by two opposite shifts of its oscillating point, say one "positive shift" that follows the vortex stream and one "negative shift" in the opposite direction.

By and large, the alternative "anti-gravity principle" to adopt is as follows. The electromagnetic oscillation path is closely related to the relevant wave length**:** it should be possible to create an electromagnetic wave whose length allows one to keep the "negative" section of the wave amplitude and strength under the desired control, in order to resist and modify the local effect of the plenum's gravitational circulation.

The theoretical possibility of such a control over gravity, in the context of the paradigm outlined here, is suggested by the fact that any wave, whatever its shape, amplitude and length, can be decomposed into – and therefore produced by – a convenient combination of a sufficiently large

number of different sinusoidal waves (e. g., according to the theory of Fourier series [5]). An extreme theoretical possibility is of an almost infinite wave-length associated with a section of the wave amplitude that keeps constantly "negative" and strong enough to modify and control local gravitational streams of plenum.

A simple theoretical possibility is provided by the example that follows**:** suppose one wants to keep the "negative" amplitude of the electromagnetic wave at any needed constant value "–*K* ". An appropriate choice could be selecting and coupling two simultaneous harmonic (sinusoidal) electromagnetic long-waves, both having equal amplitude and frequency but different phase, in a view to get the following combined wave

[a14] $$K_1 \,\mathbf{sin}\mu t + K_2 \,\mathbf{sin}(\pi/2 - \mu t) = -K = constant\ ,$$

in which μ is the wave frequency and t is time. To achieve this goal, instead of keeping coefficients K constant, one should *modulate* their amplitude to obtain two variable coefficients, the first one varying with " $-\mathbf{sin}\mu t$ " [i.e., $K_1(t) = -K\mathbf{sin}\mu t$], and the second one with "$-\mathbf{cos}\mu t$ " [i.e., $K_2(t) = -K\mathbf{cos}\mu t$], so as to re-write Equation **[a14]** in the following way**:**

[a14'] $$(-K\mathbf{sin}\mu t)\mathbf{sin}\mu t + (-K\mathbf{cos}\mu t)\mathbf{sin}(\pi/2 - \mu t) = -K\,(\mathbf{sin}^2\mu t + \mathbf{cos}^2\mu t) = -K = constant\ .$$

In practice, any designed electromagnetic wave length and amplitude can be realised to an effective degree of approximation by an adequate combination of sinusoidal (harmonic) waves. Just as an example**:** one might design a wave profile shaped like a logarithmic curve. Sections of such a curve could express the amplitude and shape of a suitably strong electromagnetic wave used to control gravity. The use would consist of an appropriate and constant emission, from/around the body to govern against gravity, of combined sinusoidal waves resulting in a wave amplitude and length fit for the control purposes.

The problem to solve seems to be merely of a technological nature, and the solution should not be *too* difficult.

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[5] Fourier trigonometric series to fit a given function $y = f(x)$ can be expressed either by

$$f(x) = a_o/2 + (1/\pi)\sum_{k=1}^{n\to\infty}{}_k \left[(\mathbf{sin}kx \int_0^{2\pi} f(x)\mathbf{sin}kx\ \mathbf{d}x) + (\mathbf{cos}kx \int_0^{2\pi} f(x)\mathbf{cos}kx\ \mathbf{d}x) \right],$$

or else - more synthetically - using complex number notation, by

$$f(x) = \sum_{-\infty}^{+\infty}{}_k \left[(\mathbf{e}^{ikx}/2\pi) \int_0^{2\pi} f(x)\ \mathbf{e}^{-ikx}\,\mathbf{d}x \right].$$