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GALACTIC CLOUD

According to 'MATTER (Re-examined)'

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Abstract: Free 3D matter-particles and other debris, present in a region of space, may gather under gravitational attraction to form a galactic cloud. Development of a galactic cloud depends on its total 3D matter-content and spin-speed. Galactic cloud (or region within a galactic cloud), with low or no spin-speed, condenses to form a black-hole, under gravitational collapse. Outer regions of a galactic cloud, with higher spin speed, condense to form stable galaxy. A galaxy may remain stable only for a short while. As spin speed of galaxy increases, its 3D matter-content gradually disburses or reverts into universal medium.

Keywords: Galactic cloud, galaxy, black hole, galactic spin.

Major part of 3D matter is created, formed, developed and differentiated into various chemical elements and compounds under conditions of great natural upheavals. Chaotic conditions simultaneously produce lot of photons with high 3D matter-content, which can form primary 3D matter-particles in place, before they radiate away. Once primary 3D matter-particles are formed, further development into fundamental matter-particles, atoms and molecules takes place by natural selection and by chance. Gravitational actions sustain stability and integrity of basic 3D matter-particles and gravitational attractions help development of superior 3D matter-particles by combinations of basic 3D matter-particles.

Many of the atoms or groups of atoms, formed during chaotic conditions (created during super novae or accidental collision between large macro bodies), are blown away far out into space from the place of their formation, by external efforts. Such dust particles and other debris are common in inter-galactic space. In inter-galactic space, gravitational attraction between dust particles and other 3D matter-bodies is very less due to enormous distances between them. However, if they are attracted strongly enough by a large macro body, they move and fall in to that macro body. Otherwise, they remain as floating 3D matter-particles in space, moving as dictated by gravitational attractions towards any other 3D matter-bodies. When there is a very large quantity of dust particles and other debris in a region in space, gravitational attraction bring them nearer to form a macro body, called galactic cloud.

In all macro bodies, inter-particle gravitational attractions continuously attempt to bring 3D matter-particles nearer. Consequently, all large macro bodies gradually reduce in volume. This process may be called 'gravitational collapse'. Gravitational collapse of a macro body is a gradual process that continues

until volume of its matter-content is reduced sufficiently so that collapsing efforts is compensated by macro body's internal pressure, provided by 'apparent repulsions' between constituent 3D matter-particles. Gravitational collapse acts as external compression on 3D matter-particles of a macro body. Magnitude of external compression gradually increases towards macro body's center.

During gravitational collapse of a large macro body, all of its 3D matter-particles tend to move towards macro body's centre. However, depending on relative positions of 3D matter-particles within the macro body, especially in a macro body with uneven distribution of 3D matter-particles, each of them may have gravitational attraction of diverse magnitudes in directions different from radial lines of the macro body. Resultant of uneven directions of gravitational attractions on 3D matter-particles gives them not only radial motion but also an angular motion about centre of macro body. As a result of angular motions of constituent 3D matter-particles, whole of the macro body develops spin motion about its centre, during gravitational collapse.

3D matter-particles, in free state and in free space, are at their highest 3D matter-content levels. As they come nearer within a macro body or when they are under external pressure, they lose parts of their 3D matter-contents and become hot [1]. Compression of a macro body tends to reduce its volumetric size. This is possible by reducing inter-atomic and inter-molecular spaces (by bringing constituent atoms and molecules nearer) against 'apparent repulsions' that keep them at stable distances from each other in an integral macro body. Moving constituent 3D matter-particles of a macro body nearer, increases inter-particle 'apparent repulsions', which in turn increases internal pressure within, by increasing reaction against external pressure.

Internal pressure within a macro body acts as external pressure on all its constituent 3D matter-particles. External pressure compels them to discard parts of their 3D matter-contents. Lowered 3D matter-content levels of 3D matter-particles gradually change physical state of macro body into fluid state. If matter-contents, discarded from 3D matter-particles are less, they may be absorbed by surrounding universal medium, to spread itself outwards. Outward displacement of universal medium appears as 'gravitational repulsion' (which may create repulsive inertial motion).

When 3D matter-contents, discarded from 3D matter-particles, are more than that can be readily absorbed by surrounding universal medium, they are converted into photons, which radiate away from the region. Large macro bodies (black holes, stars, large planets, etc.) radiate 3D matter and energy in this manner (due to their gravitational collapse). They do not require hydrogen fusion or other nuclear reactions to produce 3D matter and energy radiations from them, as is believed today.

Further development of a galactic cloud depends on total 3D matter-content in it and nature of its gravitational collapse. Depending on its physical size and parameters of spin motion, a galactic cloud may develop into a single macro body or into a number of separate macro bodies of various sizes in a group or it may disburse whole of its 3D matter-particles in few parallel planes in space.

In due time, a galactic cloud collapses and condenses to form a large macro body under action of gravitational attraction between its constituent 3D matter particles. This macro body is mainly in gaseous state with few solid or liquid 3D matter-bodies in them. Generally, it can be considered as of fluid nature. A fluid macro body has low viscosity. Adhesion due to inter-particle 'field forces' and mutual gravitational attractions between its constituent 3D matter-particles provide bonds between its constituents. Actions by these efforts, to reduce radial size at an accelerating pace, cause macro body's gravitational collapse.

A free fluid macro body, situated in free space and under gravitational collapse, tends to assume spherical shape. If efforts, moulding a macro body into spherical shape, due to gravitational collapse are uniform from all directions, the macro body will not gain spin motion. 3D matter-content, within a non-spinning (or with insufficient spin-speed) galactic cloud, may condense into single macro body.

It is improbable that inward radial motions (due to gravitational collapse) of different parts of a large galactic cloud of diverse contents are uniform from all directions. Movements of 3D matter-particles (in radial direction towards center) and uneven shape of galactic cloud during developmental stage invariably give it a spin motion about one of the axes through center. Outer regions of the macro body

attain greater spin speed about spin axis, compared to inner regions. Uneven radial motions of different parts of the fluid macro body induce its accelerating spin motion. Due to low viscosity, in fluid macro bodies, 'centripetal force' (provided by mutual gravitational attraction between 3D matter-particles) is very low. Hence, during spin motion, a fluid macro body in free space (not restricted by a container) has a tendency to spread outwards from its spin axis.

If no additional external torque is supplied to the rotating fluid macro body, magnitude of total additional work associated with it, remains constant. The fluid macro body should continue to rotate at a constant angular speed with respect to absolute reference. However, changes in its body-parameters are bound to affect fluid macro body's state of rotary motion. As the spinning (fluid macro) body expands in diameter, 3D matter-particles at its periphery continue to move away from centre of rotation (centrifugal action). If the fluid macro body has to maintain its original angular speed, outward-moving 3D matter-particles have to move faster in their circular paths. Without additional work, linear speeds of 3D matter-particles reduce as they move away from centre of rotation, with corresponding reduction in angular speed of fluid macro body.

Outward displacement of macro body's 3D matter-particles continue until sufficient 'centripetal force' can be provided to arrest their outward displacement (centrifugal action on them). As total 3D matter content of the fluid macro body remains same and expansion of its radial size continues, magnitude of 'centripetal actions' can only reduce, rather than increase. Tendency of expansion of spinning fluid macro body acts in direct opposition to actions of its gravitational collapse. In such a spinning fluid macro body, every 3D matter-particle tends move away from the centre of rotation of the fluid macro body due to its angular motion, while 'centripetal force', provided by gravitational collapse tends to move them towards the centre of rotation. Balance between these actions determines future formation of the fluid macro body – a galactic cloud.

Magnitude of 'centripetal force', F_c, required for a 3D matter particle (situated on the outer periphery) of the spinning fluid macro body, to maintain its motion in a circular path;

$$F_c = 4mv \operatorname{Tan} \omega \quad \text{(by equation (5/9) in reference [1])} \qquad \textbf{(1)}$$

where 'm' is mass of 3D matter-particle, 'v' is its tangential linear speed and 'ω' is its angular speed about spin axis of the fluid macro body.

[In case of a 3D matter-particle, moving in circular path around spin axis of fluid macro body, 'centripetal force' is the only external effort on it. 'Centripetal force' of magnitude, corresponding to equation (1) alone can maintain circular path of a linearly moving 3D matter-particle in circular path. There is no need for an assumed 'centrifugal force'. Linear speed of 3D matter-particle should remain constant and constant magnitude of 'centripetal force' must continuously act on it.

If magnitude of 'centripetal force' is less than ($4 m v \operatorname{Tan} \omega$), linear speed of 3D matter-particle gradually increases and it will move away from centre of its circular path to trace larger circular path. If magnitude of 'centripetal force' is greater than ($4 m v \operatorname{Tan} \omega$), linear speed of 3D matter-particle reduces and it will gradually move towards centre of its circular path to trace a smaller circular path.]

This inward effort is provided mainly by gravitational attraction between 3D matter-particle and rest of the macro body. By using inverse square law for approximate magnitude of gravitational attraction in 3D spatial system, F_g;

$$F_g = \frac{MmG}{R^2}$$

Where 'm' is mass of 3D matter-particle, 'M' is mass of rest of the fluid macro body, 'G' is gravitational constant in 3D spatial system and 'R' is the radius of fluid macro body, taken as average distance between 3D matter-particle and rest of all 3D matter-particles of spinning fluid macro body. We shall assume mass of a macro body represents its 3D matter-content.

For stable state of radial size of spinning fluid macro body, its 3D matter particles (on an average) should move in steady circular paths. This can be achieved only when magnitudes of 'centripetal force' on them should be as given by equation (1). Hence, a spinning (free) fluid macro body can maintain

constant radial size, only when gravitational attraction, F_g, is equal to the required 'centripetal force', F_c, on every 3D matter-particle in it.

$$\frac{MmG}{R^2} = 4mv\,\mathrm{Tan}\,\omega, \qquad \frac{MG}{R^2} = 4R\omega\,\mathrm{Tan}\,\omega, \qquad \frac{MG}{4R^3} = \omega\,\mathrm{Tan}\,\omega$$

$$\left(\frac{MG}{4}\right)\frac{1}{R^3} = \omega\,\mathrm{Tan}\,\omega \qquad \textbf{(2)}$$

For critical equilibrium of radial size of a spinning galactic cloud in the plane of its spin, equation (2) has to be satisfied for every one of its 3D matter-particle. In equation (2), 'ω' is galactic cloud's angular speed and 'R' is its radius. For a galactic cloud, the term (MG/4) is a constant. Hence, $(\omega\,\mathrm{Tan}\,\omega)$ is inversely proportional to cube of its radius. 3D matter-particles, whose motions do not satisfy this condition, move towards or away from centre of galactic cloud.

Putting; $\omega = \frac{v}{R}$ in equation (2),

$$\left(\frac{MG}{4}\right)\frac{1}{R^3} = \frac{v}{R}\mathrm{Tan}\,\omega, \qquad \left(\frac{MG}{4}\right)\frac{1}{R^2 v} = \mathrm{Tan}\,\omega$$

Highest linear speed, at which a 3D matter-particle may move, is speed of light. Linear speed of 3D matter-particles near periphery of a stable galaxy may be approximated to speed of light, c.

Therefore; $\frac{MG}{4R^2c} = \mathrm{Tan}\,\omega$

Approximate spin speed of a galactic cloud in its critical equilibrium,

$$\omega = \mathrm{Tan}^{-1}\frac{MG}{4R^2c} \qquad \textbf{(3)}$$

Gravitational collapse and accelerating spin motion of a galactic cloud cannot be stopped. Hence, these actions will continue to change parameters of a galactic cloud, even if it is in the form of a stable galaxy for certain duration. A spinning galactic cloud, in free space, will expand until its angular speed is sufficiently lowered, when 'centripetal force' is sufficient to maintain curvature of its periphery. However, such a macro body can sustain its stability of radial size only as long as equation (2) is satisfied.

Should magnitude of angular speed 'ω' or radius 'R' of a galactic cloud become comparatively more, in equation (2), inward radial motion of its 3D matter-particles (due to gravitational collapse) will become too less to compensate for their outward displacement due to motion in circular paths. 3D matter-content of galactic cloud will continue to spread outwards in the planes of its spin.

As linear speeds of 3D matter-particles, in their circular path, approach the speed of light, superior matter-particles breakdown to primary 3D matter-particles and form 'halo' around equatorial plane of galactic cloud. Halo, formed around a galactic cloud (in conjunction with halos around similar galactic clouds), tends to arrest whole-body linear motion of galactic cloud towards any other similar macro body and keep it steady in space to form a stable galaxy, for further inner development. Absence of translational motions of stable galaxies (towards each other), by formation of halos, helps to maintain a steady state of the universe.

A very large galactic cloud, during its condensation period, may be fragmented into many smaller clouds by uneven distribution of its 3D matter-content and by spinning motion of the cloud, as is envisaged by 'Nebular hypothesis'. These smaller clouds further condense into separate macro bodies but simultaneously being constituents of the same group. In this case, total 3D matter-content of combined macro body is distributed over a wider region and hence there is no concentration of its 3D matter-content (mass) in a place. Light or other radiations, escaping from the region of a galactic cloud are not slowed down very much and hence these types of groups of macro bodies, called stable 'galaxies', are visible to outside observers within the universe.

Galactic stability, which is related to translational motion of one galaxy towards another, is a short

lived phenomenon. Otherwise, a galaxy may never reach stable state. A galaxy is a combined macro body, whose constituent 3D matter-bodies are continuously moving and evolving. Galaxy, itself, changes its parameters continuously.

If spin speed of a galaxy increases beyond that can be supported by equation (3), gradually whole of its 3D matter-content will be disbursed and reverted back into universal medium. If its spin speed reduces to less than that can be supported by equation (3), the galactic cloud will gradually collapse towards its central region. This is applicable to central region of a stable galaxy also, where spin speed (or linear speed in circular path) is less. Due to lower linear speed in circular path, 3D matter-particles in this region move towards central region and form super dense macro body, known as 'black hole'. Stable size and nature of a galactic cloud (formed in free space by accumulation of inter-galactic clouds and debris) is determined by its spin speed during its formation. With low or no spin speed, a galactic cloud will condense to become a 'black hole'.

Conclusion:

Sundry 3D matter-particles and debris in space form galactic clouds. Developments of a galactic cloud depend on its total 3D matter-content and spin speed. Outer regions of a galactic cloud, with higher spin speed, condense to from stable galaxies. Constituents of a stable galaxy will be disbursed, at a later stage, due to higher spin speed. Very large galactic clouds or central regions of stable galaxies, which have relatively lower spin speeds, condense to become 'Black holes'.

Reference:

[1] Nainan K. Varghese, *MATTER (Re-examined)*, http://www.matterdoc.info

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