GALACTIC CLOUD

According to 'MATTER (Re-examined)'

Nainan K. Varghese, matterdoc@gmail.com
https://www.matterdoc.in

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

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

A major part of 3D matter is created, formed, developed and differentiated into various chemical elements and compounds during the conditions of great natural upheavals. Chaotic conditions produce numerous corpuscles of radiation (photons) with high 3D matter content simultaneously, which can form primary 3D matter-particles in situ before they radiate away. Once the primary 3D matter-particles are formed, further development into fundamental 3D matter-particles, atoms and molecules takes place by natural selection and by chance. Gravitational actions sustain the stability and integrity of basic 3D matter-particles, and gravitational attractions help the 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 supernovae or accidental collision between large macrobodies), are blown away far out into space from the place of their formation by external efforts (forces).

Such dust particles and other debris are common in intergalactic space. In intergalactic space, gravitational attraction between dust particles and other material bodies is very low due to the enormous distances between them. However, if they are attracted strongly enough by a large macrobody, they move and fall into that macrobody. Otherwise, they remain as floating 3D matter-particles in space, moving as dictated by gravitational attractions towards any other 3D material bodies. When there is a very large quantity of dust particles and other debris in a region in space, mutual gravitational attraction gathers them to form a macrobody, called a galactic cloud. In all macrobodies, inter-particle gravitational attractions continuously attempt to bring the 3D matter-particles nearer. Consequently, all large macrobodies gradually reduce in volume. This process may be called 'gravitational collapse'. Gravitational collapse of a macrobody is a gradual process that continues until the volume of its 3D matter-content is reduced sufficiently so that the collapsing efforts are compensated by the macrobody's internal pressure, provided by 'apparent repulsions' between constituent 3D matter-particles.

Gravitational collapse acts as external compression on a macrobody. The magnitude of external compression gradually increases towards the macrobody's centre. During the gravitational collapse of a large macrobody, all of its 3D matter-particles tend to move towards the macrobody's centre. However, depending on the relative positions of the 3D matter-particles within the macrobody, especially in a macrobody with an uneven distribution of 3D matter-particles, each of them may have a gravitational attraction of diverse magnitudes in directions different from the radial lines of the macrobody. The result of uneven directions of gravitational attractions on the 3D matter-particles gives them not only radial motion but also an angular motion about the centre of the macrobody. As a result of the angular motions of constituent 3D matter-particles, the whole of the macrobody develops a rotary motion about its centre during the gravitational collapse. 3D matter-particles, in free state and in free space, are at their highest 3D matter-content levels. As the 3D matter-particles come nearer within a macrobody or are under external pressure, they lose parts of their 3D matter-contents and become hot. Compression of a macrobody 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 macrobody. Moving constituent 3D matter-particles of a macrobody nearer increases inter-particle 'apparent repulsions', which in turn increases the internal pressure of the macrobody. Compression of a macrobody creates internal pressure within by the reaction against the external pressure on it. Internal pressure within a macrobody 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 the physical state of the macrobody into a fluid state.

If the 3D matter-contents, discarded from the 3D matter-particles are less, they may be absorbed by the surrounding universal medium, to spread itself outwards. Outward expansion of the universal medium appears as 'gravitational repulsion' (which may create repulsive inertial motion). When the 3D matter-contents, discarded from 3D matter-particles, are more than that can be readily absorbed by the surrounding universal medium, they are converted into photons, which radiate away from the region. Large macrobodies (black holes, stars, large planets, etc.) radiate 3D matter and energy (work) 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 the total 3D matter-content in it and the nature of its gravitational collapse. Depending on its physical size and parameters of spin motion, a galactic cloud may develop into a single macrobody or into a number of separate macrobodies of various sizes in a group, or it may disperse all of its 3D matter-particles in a few parallel planes in space. In due time, a galactic cloud collapses and condenses to form a large macrobody under the action of gravitational attraction between its constituent 3D matter particles. This macrobody is mainly in a gaseous state with few solid or liquid material bodies in it. Generally, it can be considered to be of a fluid nature. A fluid macrobody has low viscosity. Adhesion due to inter-particle 'field efforts' and mutual gravitational attractions between its constituent 3D matter-particles provides bonds between its constituents. Actions by these efforts, to reduce its radial size at an accelerating pace, cause the macrobody's gravitational collapse.

A free fluid macrobody, situated in free space and under gravitational collapse, tends to assume spherical shape. If the efforts, moulding a macrobody into spherical shape, due to gravitational collapse, are uniform from all directions, the macrobody will not gain rotary motion. 3D matter-content, within a non-spinning (or with insufficient spin-speed) galactic cloud, may condense into a single macrobody. It is improbable that the 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 the centre) and the uneven shape of the galactic cloud during the developmental stage invariably give it a spin motion about one of the axes through the centre. Outer regions of the macrobody attain greater spin speed about the spin axis, compared to inner regions. Uneven radial motions of different parts of the fluid macrobody induce its accelerating spin motion. Due to low viscosity, in fluid macrobodies, 'centripetal force' (provided by mutual gravitational attraction between 3D matter-particles) is very low. Hence, during spin motion, a fluid macrobody 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 macrobody, the magnitude of total additional work associated with it remains constant. The fluid macrobody should continue to rotate at a constant angular speed with respect to the absolute reference. However, changes in its body parameters are bound to affect the fluid macrobody'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 the centre of rotation (centrifugal action). If the fluid macrobody 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 the centre of rotation, with a corresponding reduction in the angular speed of the fluid macrobody. Outward displacement of macrobody's 3D matter-particles continues until sufficient 'centripetal force' can be provided to arrest their outward displacement (centrifugal action on them). As the total 3D matter-content of the fluid macrobody remains the same and expansion of its radial size continues, the magnitude of 'centripetal actions' can only reduce, rather than increase. The tendency of expansion of the spinning fluid macrobody acts in direct opposition to the actions of its gravitational collapse. In such a spinning fluid macrobody, every 3D matter-particle tends to move away from the centre of rotation of the fluid macrobody due to its angular motion, while the 'centripetal effort', provided by gravitational collapse, tends to move them towards the centre of rotation. The balance between these actions determines future formation of the fluid macrobody – a galactic cloud.

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

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

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

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

If magnitude of 'centripetal force' is less than ($4mv\,\mathrm{Tan}\omega$), linear speed of the 3D matter-particle gradually increases, and it will gradually move away from the centre of its circular path to trace a larger circular path. If magnitude of 'centripetal force' is greater than ($4mv\,\mathrm{Tan}\omega$), 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 the 3D matter-particle and the rest of the macrobody. By using the inverse square law for the approximate magnitude of gravitational attraction in the 3D spatial system, Fg;

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

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

For a stable state of radial size of spinning fluid macrobody, its 3D matter-particles (on average) should move in steady circular paths. This can be achieved only when the magnitudes of 'centripetal effort' on them are as given by equation (1). Hence, a spinning (free) fluid macrobody can maintain constant radial size only when gravitational attraction, Fg, is equal to the required 'centripetal effort', Fc, on every 3D matter-particle in it.

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

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

For the 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-particles. In equation (2), 'ω' is the 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 motion does not satisfy this condition, move towards or away from the centre of the galactic cloud.

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

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

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

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

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

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

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

Should the magnitude of angular speed 'ω' or radius 'R' of a galactic cloud become comparatively larger, in equation (2), inward radial motion of its 3D matter-particles (due to gravitational collapse) will become too small to compensate for their outward displacement due to the 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 3D matter-particles break down to primary 3D matter-particles and form a 'halo' around the equatorial plane of the galactic cloud. Halo, formed around a galactic cloud (in conjunction with halos around similar galactic clouds), tends to arrest the whole-body linear motion of the galactic cloud towards any other similar macrobody and keep it steady in space, and form a stable galaxy for further inner development. The absence of translational motions of stable galaxies (towards each other) by the formation of halos helps maintain a steady state 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 the spinning motion of the cloud, as is envisaged by the 'Nebular hypothesis'. These smaller clouds further condense into separate macrobodies, but are simultaneously constituents of the same group. In this case, the total 3D matter-content of the combined macrobody 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 macrobodies, called stable 'galaxies', are visible to outside observers within the universe.

Galactic stability, which is related to the translational motion of one galaxy towards another, is a short-lived phenomenon. Otherwise, a galaxy may never reach a stable state. A galaxy is a combined macrobody whose constituent material bodies are continuously moving and evolving. Galaxy itself changes its parameters continuously.

If the spin speed of a galaxy increases beyond what can be supported by equation (3), gradually the whole of its 3D matter-content will be dispersed and reverted back into the universal medium. If its spin speed reduces to less than that which can be supported by equation (3), the galactic cloud will gradually collapse towards its central region. This is applicable to the central region of a stable galaxy, where the spin speed is lower. Due to lower spin speed, 3D matter-particles in this region move towards the central region and form a super dense macrobody, known as a 'black hole'. The stable size and nature of a galactic cloud (formed in free space by the accumulation of intergalactic clouds and debris) are 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 (mass) and spin speed. Outer regions of a galactic cloud, with higher spin speed, condense to form stable galaxies. Constituents of a stable galaxy will be dispersed, 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)*, https://www.matterdoc.in/

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