Chapter 11

Applying CFLE Theory to the Galaxy

11.1. Mass of the Milky Way by Keplerian Mechanics

Our sun revolves around the Milky Way galaxy, taking approximately 2.5×10^8 years to make one revolution, at approximately 10 Kpc away from the galaxy center.

According to Kepler's third law, the mass of the galaxy $M_\otimes$ is

$$\frac{(M_\otimes + M_\odot)}{M_\odot} \doteqdot \frac{M_\otimes}{M_\odot} = \frac{R^3}{p^2}$$

$M_\otimes \doteqdot 2 \times 10^{11}\ M_\odot$ (= $2 \times 2 \times 10^{30}$ kg)

$\doteqdot 4 \times 10^{41}$ kg 11-1-1

This mass is the typical mass of the galaxy and is called the Keplerian galaxy mass.

11.2 Introduction of Galaxy Force Lines and Galaxy Force Line Elements by CFLE Theory

As discussed in §8, objects outside of the galactic center (stars) have only force strength

$F_g = F\,(4.027 \times 10^{56})$ 11-2-1

Therefore, they can bind maximally only $174 M_\odot$ (= 3.5×10^{32} kg). However, even Kepler's galaxy mass is tremendously big in the viewpoint of a strong force. Therefore, according to CFLE theory, for a huge gravitational system like a galaxy to bind, we need to add another kind of force and its proper force line and force line elements. Because this force applies to binding in a huge gravitational system, it is called the galactic force. According to CFLE theory, the scale of the galactic force is

$$F_g = (4.027012 \times 10^{56})\,(1.190208 \times 10^{7})^2$$

$$= 5.704645 \times 10^{70} \qquad 11\text{-}2\text{-}2$$

This force strength is a quantized galactic force. Because every force has its force lines and force line elements (cf. §6), a galactic force must also have galactic force lines and galactic force line elements. This galactic force line and its seed are expressed in Figure 11-2-1.

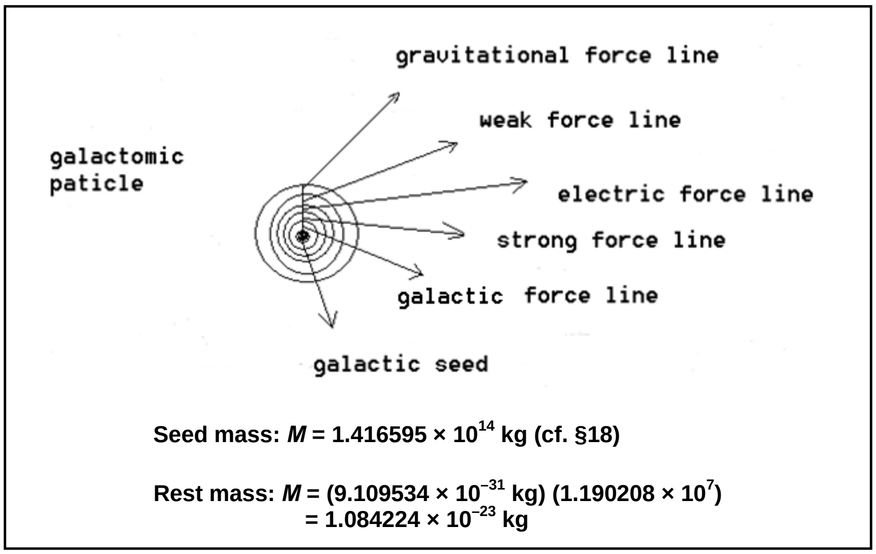


Figure 11-2-1. ± Galactron

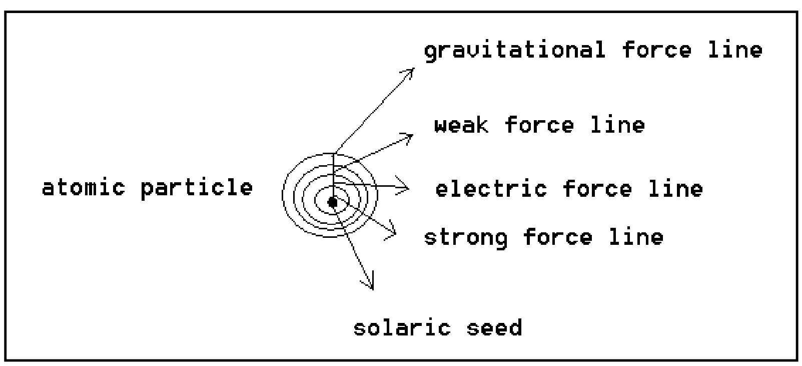


Figure 11-2-2. Electron and positron

As discussed in §6.6, the atomic particle is one of the fundamental particles of nature, and likewise this galactomic particle is very important for an exact understanding of galactic phenomena. In the case of the galactic force, the atomic counterpart is called the galactom (from the name atom), and like the electrons and protons of an atom (sometimes called a solaratom), the galactom likewise has a negative galactron (from the name electron) and a positive galacton (from the name proton). When these galactoms build elements, these are called galactomic elements. Gauge boson that is build with galactic force line, is called galaxon. The validity of this naming system will be proven during the descriptions of galaxy evolution and gamma ray busters in the sections that follow.

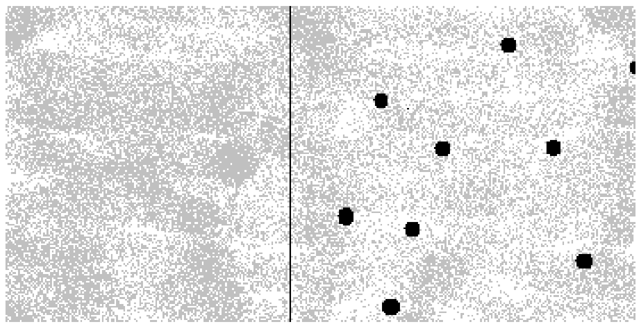
Observational evidence for the existence of these particles is discussed in §21: *Solving the carrier mystery of diffuse interstellar bands by CFLE theory*.

11.3. Solving the Problem of Mass Density Fluctuation and the Small-Scale Inhomogeneity Problem of the Universe by CFLE Theory

The fluctuations in cosmic microwave background radiation are what lead to the structures seen by astronomers. The large-scale structure of the universe consists of some regions in which few galaxies exist and some regions in which many galaxies are present. The former are called giant voids and the latter are called galaxy clusters. The size across these regions is roughly 50 million light years. The origins of these large-scale structures are assumed to be well understood. The accepted theory is that, in the early universe, those volumes of space with slightly greater mass/energy attracted the matter in surrounding volumes and became denser. The matter in these volumes then collapsed under the influence of gravity, thereby forming galaxy clusters. Likewise, those volumes with slightly less mass/energy lost matter to the denser surrounding regions and became less dense, eventually ending up as the giant voids.

The universe also has other kinds of lumpiness or inhomogeneities. Galaxy clusters consist of dozens and dozens of galaxies, and galaxies consist of tens of billions of stars, all of which have mostly empty space between them. These finer structures were produced in the same manner as the larger-scale structures, that is, in terms of smaller fluctuations in the mass/energy density of the early universe. Because the visible universe consists of so many causally distinct regions, in a Friedman-Robertson-Walker cosmology, it is impossible to account for the character of the structure all on one scale. One would expect huge density fluctuations at the distances larger than those associated with a causally distinct volume, medium fluctuations at a site associated with the boundary of such volume, and much smaller fluctuations at the scale smaller than the size of the volume. However, observations indicate that the size of the fluctuations at all these various scales needs to be roughly of the same order of magnitude.

In the CFLE theory, however, such density fluctuation problem cannot occur, Because every galactron, galacton, and galactom has its own very heavy seed that screens its mass by force line elements, it does not need density fluctuations, as demonstrated in Figure 11-3-1.



(A) (B)

Figure 11-3-1

In the currently accepted picture of cosmology, the mass density of space is homogeneous, as depicted in Figure 11-3-1(A), and the global mass density and local mass density are considered to be symmetrical. In the cosmology of CFLE theory, however, as depicted in Figure 11-3-1(B), the local mass density is not homogeneous but instead has heavy seeds scattered throughout the homogenous global mass density. This means that the local symmetry of mass density is broken by the seeds of galactrons, and therefore we can have a universe with small-scale structures in the galaxy clusters, namely galaxies, stars, and planets. Despite that a galaxy's density is homogenous globally, the mass density is not homogenous locally because there is another kind of seed in the universe (cf. §13). Because the present theory does not have such hierarchical force line elements and seeds, the theory cannot have a hierarchical universe. Despite this, in the CFLE theory, the degree of disorder and entropy increases globally by global expansion of the Big-Bang, and it is possible to have a gravitational system in which a locally decreased degree of disorder or entropy for living objects occurs under negentropy and order. Such a hierarchical structure could be called a "local contraction possible structure" or "life possible structure against global mass density symmetry" by global expansion.

11.4. Quantized Galaxy Mass Obtained by the Galactic Force

In §8, the quantized stellar mass $M_{\odot}$ was calculated to be

$$M_{\odot} = 9.943053 \times 10^{29} \text{ kg} \qquad 11\text{-}4\text{-}1$$

However, the galactic force is $(1.190208 \times 10^{7})^{2}$ times stronger than a strong force, and thus the minimum binding mass by the galactic force is

$$M_{\otimes} = (9.943053 \times 10^{29} \text{ kg})\,(1.416595 \times 10^{14})$$

$$= 1.408528 \times 10^{44} \text{ kg} \qquad 11\text{-}4\text{-}2$$

This mass is the quantized unit mass of the galaxy.

11.5. Solving the Galaxy Dark Matter Problem by CFLE Theory

From §11.1, the Keplerian galaxy mass was determined to be

$$M_{\otimes k} = 2 \times 10^{11}\, M_{\odot}$$

$$= (2 \times 10^{11})\,(2 \times 10^{30} \text{ kg})$$

$$= 4 \times 10^{41} \text{ kg} \qquad 11\text{-}5\text{-}1$$

But, from §11.4, we know that the predicted value of the galaxy's mass by CFLE theory is

$$M_{\otimes c} = 1.409 \times 10^{44} \text{ kg} \qquad 11\text{-}5\text{-}2$$

This mass difference can be called the dark matter of the galaxy. That is

$$\frac{M_{\otimes c}}{M_{\otimes k}} = \frac{1.409 \times 10^{44} \text{ kg}}{4.179 \times 10^{41} \text{ kg}}$$

$$= 337.16 \qquad 11\text{-}5\text{-}3$$

The essence of this difference of 337.16 is the dark factor $g^2 = (6.545979)^2 = 42.849841$ (cf. §7.15, Eq. 7-15-14). However, to build a galaxy, the galactic force and its force line are needed; therefore, the dark factor of the galaxy is

$$g_{\text{gal}} = g^2 \cdot g_{\text{g.f}}$$

$$= (42.849841)(6.545979)$$

$$= 280.494160 \qquad 11\text{-}5\text{-}4$$

This factor is called factor of galaxy dark matter

where $g_{\text{g.f}}$ is the force line curve of the galactic force line.

The nett difference is

$$d_{\text{nett}} = \frac{337.16}{280.49}$$

$$=1.202 \qquad 11\text{-}5\text{-}5$$

this factor 1.202 is called keplerian missing factor f_k from Eq.5-4-2

Therefore, the real distance from the galactic center to the sun is

$$d = \frac{10 \text{ Kpc}}{1.202}$$

$$= 8.319 \text{ Kpc} \qquad 11\text{-}5\text{-}6$$

$$R_{\otimes\odot} = (8.319 \times 10^3 \text{ pc})(3.086 \times 10^{16} \text{ m})$$

$$= 2.567\times 10^{20} \text{ m (27,200 light years)} \qquad 11\text{-}5\text{-}7$$

The observed value of this distance is

d = 8.34 Kpc $\pm$ 0.34 Kpc = (25,000 ~ 28,000 light years)

where 1 pc is 3.262 light years.

Expected value for observational galaxy mass by kepler's law is

$$M_{\otimes} = (8.2 \times 10^{36} kg)(8.449092)^4$$

$$= 4.179 \times 10^{41} kg$$

$$\approx 2 \times 10^{11} M_{\odot} \qquad 11\text{-}5\text{-}8$$

This mass of Milky Way is called keplerian mass of Milky Way.

Where factor of force line curve $g = 8.449092$ is for galaxy dark matter density by star luminosity at galactic center. $x_{ge} = \frac{(1.202)}{(1.033548)(1.000732)}$=1.162133 by $x_g = 1.033548$ of air at $g = 2$ and $x_e = 1.000732$ at $g = 1.202 \times 1.033548$

$$g = \frac{(6.545979)(1.5)}{1.162133} = 8.449092 \qquad 11\text{-}5\text{-}9$$

Eq 11-5-9 is called factor of dark matter of galactic center

$$f_{\otimes center} = (8.449092)^4 = 5096.1 \qquad 11\text{-}5\text{-}10$$

$M_{\otimes centrer} =\ 8.2 \times 10^{36} kg$ is observed mass of galaxy center of Sagittarius A*.

Because the predicted value by CFLE theory agrees well with the observed value, we have proof here that CFLE theory is correct.

11.6 Solving the Dark Matter Problem from the Rotations Curve of the Galaxy by CFLE Theory

Dynamical study of the universe began in the late 1960's. This meant that instead of just looking at and classifying galaxies, astronomers began to study their internal motions (rotation of disk galaxies) and their interactions with one another, as in clusters. The question was soon developed of whether astronomers were observing the mass or the light in the universe. Most of what astronomers see in the galaxy is starlight, so clearly, the brighter the galaxy, the more stars there are in that galaxy, and therefore, the more massive the galaxy. By the 1960's, there were indications that this was not always true, giving rise to what is called the "missing mass problem."

The first indication that there was a significant fraction of missing mass matter in the universe came from study of the galaxy rotation curve. It was noticed in the rotation following Kepler's third law, whether shown as planet-like or differential rotation, that the orbital speed falls off as the rotating object goes to greater radius within the galaxy. This is called a Keplerian rotation curve (see Figure 11-6-1).

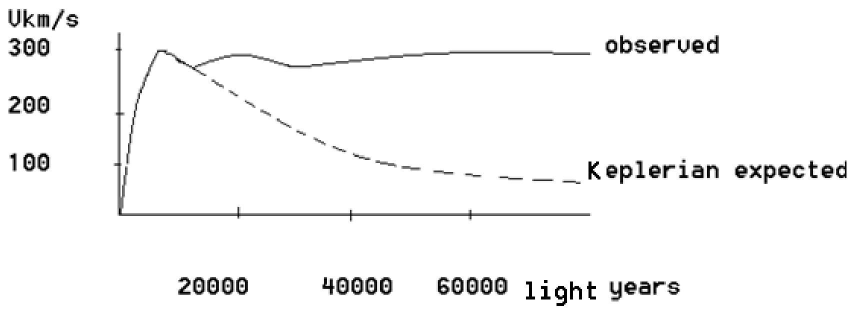


Figure 11-6-1

To determine the rotation curve of the galaxy, stars are not used because of interstellar extinction. Instead, 21 cm microwave of neutral hydrogen is used. When this is done, one finds that the rotation curve of the galaxy stays flat for a large distance, instead of falling off, as depicted in Figure 11-6-1.

From studies of the rotation of the Milky Way, the orbital period of the sun around the Milky Way has given observers a mean mass for the amount of material inside the sun's orbital. But a detailed plot of the orbital speed of the galaxy as a function of radius reveals the simplest type of rotation to be that of wheel-like rotation, as shown in Figures 11-6-2 and 11-6-3.

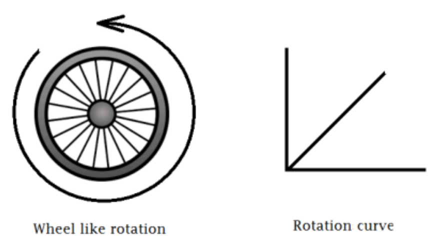


Figure 11-6-2

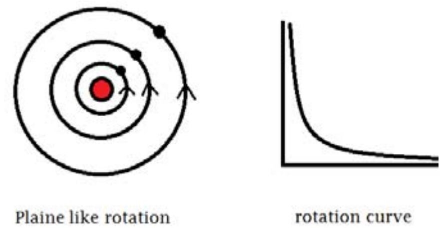
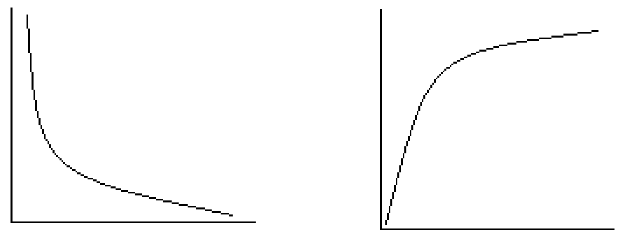


Figure 11-6-3

This means that the mass of the galaxy increases with increasing distance from the center.



Expected in the galaxy **Observed in the galaxy**

Figure 11-6-4

The problem is that there is only $\rho_{\otimes} = 0.0088 \pm 0.002 M_{\odot} pc^{-3}$ of visible matter beyond the sun's orbital distance from the center of the galaxy. Yet, the rotations curve of the galaxy indicates there is a great deal of mass, but there is no light out there! In other words, the galaxy is filled with mysterious dark matter of unknown composition and type. Despite multiple proposed suggestions (neutrino mass, macho, etc.) to solve this mystery, scientist have not been able to explain the missing matter problem in the rotation curve of the galaxy. But CFLE theory can give a clear answer to this problem, as proven below.in§7.9 ratio of dark matter is

$$\frac{\rho_C}{\rho_G} \cong \frac{1}{0.028} = 35.71 \qquad 7\text{-}9\text{-}9$$

Related force line curve is

$$g^2 = 35.71, \qquad g = \sqrt{35.71} = 5.976 \qquad 7\text{-}9\text{-}10$$

However, galacton and galactron has another force line.

Therefore ratio of dark matter in galaxy is

$$g^3 = (5.976)^3 = 213.4 \qquad 11\text{-}6\text{-}1$$

$$\frac{\rho_o}{\rho_{\otimes}} = \frac{1}{213.4} = 0.0047 \qquad 11\text{-}6\text{-}2$$

However, this value is without keplerian missing factor.

With keplerian missing factor $f_k = 1.202$ the value is

$$g_{kmf} = \frac{5.976}{1.202} = 4.972 \qquad 11\text{-}6\text{-}3$$

$$g^3 = (4.972)^3 = 122.9 \qquad 11\text{-}6\text{-}4$$

Theoretical value is

$$\frac{\rho_o}{\rho_\otimes} = \frac{1}{122.9} = 0.0081pc^{-3} \qquad 11\text{-}6\text{-}5$$

Observed value is

$$\rho_{\otimes observe} = 0.0088 \pm 0.002 M_\odot pc^{-3} \qquad 11\text{-}6\text{-}6$$

Because the theoretical and experimental values agree well, we obtain further validity of CFLE theory's accuracy.

11.7 Quantization of Galaxy Size

In §8, the quantized stellar unit size was calculated to be

$$r_\odot = 3.477370 \times 10^8 \text{ m} \qquad 11\text{-}7\text{-}1$$

Because of the increased quantity caused by the new force, $d = (1.190208 \times 10^7)^2$, the quantized galaxy unit size obtained is

$$r_\otimes = (3.480 \times 10^8 \text{ m})\,(1.417 \times 10^{14})$$

$$= 4.931 \times 10^{22} \text{ m} \qquad 11\text{-}7\text{-}2$$

However, these sizes do not consider the force line curve of the galactic force. So, the possible minimum curved unit size of a spiral disk is

$$r_\otimes = \frac{4.931 \times 10^{22} \text{ m}}{(6.545979 \times 1.5)(6.545979 \times 1.5)}$$

$$= \frac{4.931 \times 10^{22} \text{ m}}{96.41}$$

$$= 5.115 \times 10^{20} \text{ m} \qquad 11\text{-}7\text{-}3$$

where 6.545979 is the maximum force line curve of the present universe (g = 6.545797), and 1.5 is the correspondence number (c_c = 1.5)(cf.§5,§24).

The resultant 96.41 is called the possible maximum curve of the force line. This factor appears in every calculation of the maximum case for every system of a boundary quantity. Therefore, this factor is also called the horizon factor.

This size converted to unit of pc is

$$R_{\otimes} = \frac{5.115 \times 10^{20}\ \text{m}}{3.086 \times 10^{16}\ \text{m}}$$

$$= 1.657 \times 10^{4}\ \text{pc}$$

$$= 16.57\ \text{Kpc}$$

$$\approx 17\ \text{Kpc}$$

$$\approx 5.4000\ \text{light years} \qquad 11\text{-}7\text{-}4$$

The observed value for the spiral disk is

$$R_{\otimes} = 15.5 \sim 18.5\ \text{Kpc}$$

$$\approx 50{,}000 \sim 60{,}000\ \text{light years} \qquad 11\text{-}7\text{-}5$$

Again, it is clear that the predicted values calculated by CFLE theory correlate perfectly with observed values.

11.8 Quantization of Bulge Size

A bulge in the galaxy center can be thought of as corresponding to an muon's energy level of nucleus that is $g = 3.836$.

Therefore, size of next possible smaller structure (barred structure), is

$$R_{\text{B}} = \frac{5.115 \times 10^{20}\ \text{m}}{3.836}$$

$$= 1.333 \times 10^{20}\ \text{m} \qquad 11\text{-}8\text{-}1$$

Conversion of this size to light years gives

$$R_{\text{Bar}} = \frac{1.333 \times 10^{20}\ \text{m}}{9.461 \times 10^{15}\ \text{m}}$$

$$= 1.409 \times 10^{4}\ \text{light years}$$

$\approx$14,000 light years 11-8-2

And size of next possible smaller structure (the bulge), likened to the proton charge radius

$$R_{\mathrm{Bul}} = \frac{1.333 \times 10^{20}\ \mathrm{m}}{(3.836)/(1.5)}$$

$$=5.173 \times 10^{19} m$$

$$R_{\mathrm{Bul}} = \frac{5.173 \times 10^{19} m}{9.461 \times 10^{15} m}$$

$$=5.468 \times 10^{3}\ \text{light years}$$

$\approx$5,000 light years

The observed value of the bulge is

$R_{\mathrm{Bul}} \approx$ 5,000 light years 11-8-3

11.9. Quantization of the Galactic Energy

11.9.1 Macro energy quantum $\hbar_{\otimes}$ of the galaxy and the theoretical revolutions speed of the sun by CFLE theory

The macro energy quantum $\hbar_{\odot}$ of the sun is obtained from the quantum number

$$N = (1.190208 \times 10^{7})^{4}$$

Therefore, the macro energy quantum $\hbar_{\otimes}$ of the galaxy can be obtained using the additional force quantum constant. That is,

$$h_{\otimes} = (4.027012 \times 10^{56})\,(1.190208 \times 10^{7})^{2}$$

$$= 5.704645 \times 10^{70}\ \mathrm{Js}$$

$$\hbar_{\otimes} = \frac{5.704645 \times 10^{70}}{2\pi}$$

$$= 9.079226 \times 10^{69}\ \mathrm{Js} \qquad 11\text{-}9\text{-}1\text{-}1$$

Because we can now establish the macro uncertainty principle,

$\hbar_{\otimes} \geqq \Delta M_{\otimes} V_{\otimes} \, \Delta X_{\otimes}$ 11-9-1-2

we can use this formula to obtain useful information about the galaxy and its stars.

Sun's distance to galactic center is

$R_{\odot\otimes} = 27.2$ klys

$=2.567 \times 10^{20} m$

An example is the orbital speed of the sun. That is

$$V_{\odot co} \geq \frac{\hbar_{\otimes}}{\Delta M_{\otimes} \Delta X_{\odot}}$$

$$= \frac{9.079 \times 10^{69} \text{ Js}}{(1.409 \times 10^{44} \text{ kg})\,(2.567 \times 10^{20} \text{ m})}$$

$$= \frac{9.079 \times 10^{69} \text{ Js}}{3.453 \text{ x } 10^{64} \text{ kg}\cdot\text{m}}$$

$= 2.510 \times 10^{5}$ m/s

≈ 251 km/s 11-9-1-3

This is the predicted value of the sun's orbital speed around the galaxy center by CFLE theory. The observed value using the Very Long Base line array in 2009 velocities for stars at the outer edge of the Milky Way is

$V \simeq 254$ km/s 11-9-1-4

Because the theoretical value agrees well with the observed value, we have assurance here about the macro energy quantum of the galaxy $\hbar_{\otimes}$.

11.9.2 Possible maximum galaxy mass

As calculated in §8, the maximum quantized star mass is $347.286.M_{\odot}$.

$M_{\otimes m} = 347 M_{\odot} = 174 M_{\odot}$

Therefore, the possible maximum galaxy mass is

$M_{\otimes m} = (347.29 M_{\odot})\,(6.782)$

$$= 2355.32M_{\odot} \qquad 11\text{-}9\text{-}2\text{-}1$$

where the factor of 6.782 comes from $2(n)^2 = 92$, $n = 6.782$ (cf. §7.8).

Because factor of $f_t = 1.162$ (the keplerian missing factor from Eq.11-5-9is, the maximum mass number of the galaxy is

$$A_{\otimes m} = \frac{2355.32}{1.162}$$

$$=2026.95$$

$$\approx 2027 \qquad 11\text{-}9\text{-}2\text{-}2$$

This value means that, in the universe, there are galaxies that can have a mass that is 2027 times heavier than the mass of a unit galaxy mass. This value corresponds to uranium's (U) mass number in atomic elements and the maximum star mass number. Such surprising correspondence properties of nature are established quantitatively and qualitatively to the end of the universe.

11.10 Solving Mystery of Galaxy Shaping

11.10.1 The morphology of galaxies: why they have such shape?

Using the new 100 inch Mt. Wilson telescope, Edwin Hubble was able to resolve the outer part of some spiral nebular as being a collection of individual stars and he identified some Cepheid variables that allowed him to estimate the distance to the nebular. These were far too distant to be part of the Milky Way. In 1936, Hubble produced a classification system for galaxies that is used to this day. There are 4 main classes:

(1) The first group comprises the spiral galaxy, in which a typical galaxy has a disk and a central bulge: Included within this group are the whirl pool galaxy (type Sc; e.g., M51), Andromeda galaxy (type Sb; e.g., M31), galaxy in letus (type SBp; e.g., M77), sombrero galaxy (type Sa; e.g., M104), and lenticular galaxy (type So; e.g., NGC 5866).

(2) The second group comprises the barred spiral galaxies, in which a typical type has a disk and a central bulge with a bar. Included among these are galaxies in hydra (type SBc; e.g., M83), galaxies in the Virgo cluster (type SBb; e.g., Me1), and galaxy type SBb (e.g., M95).

(3) The third group comprises the elliptical galaxies, in which a typical shape is of an elliptical-shaped bulge and no disk. Included in this group are the dwarf elliptical galaxies (e.g., M32), and giant elliptical galaxies (e.g., M60).

(4) The fourth group comprises the irregular galaxies. These are all the other galaxies with irregular shapes, meaning those that result during a formation process or a collision process. All of the galaxy types can be expressed by simple diagrams, as in Figure 11-10-1-1.

But, surprisingly, even after 70 years of such classification, modern physics cannot explain why galaxies have such shapes. But CFLE theory can provide the answer, as will become apparent in the following section.

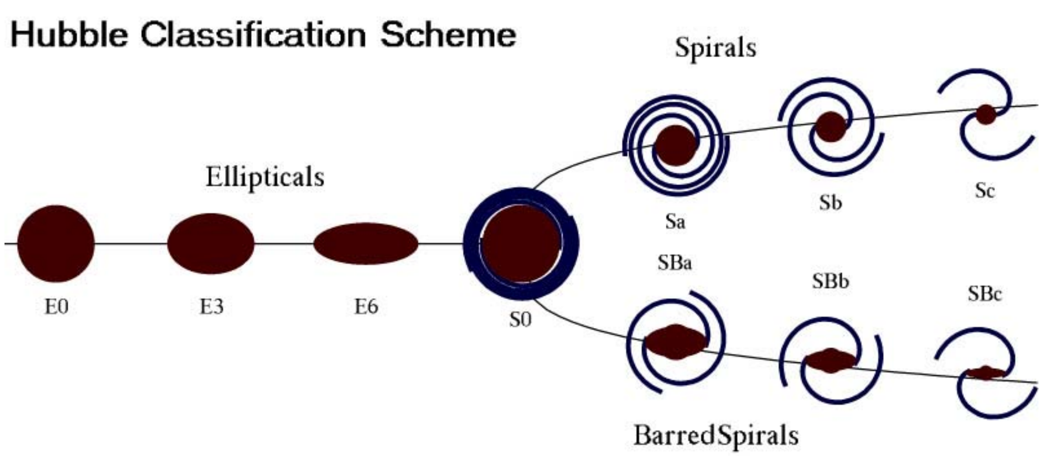


Figure 11-10-1-1

11.10.2 Galaxy form and probability density functions form by CFLE theory

§9.1 listed the quantum numbers and their corresponding eigenfunction value, expressed in the term of parameters

$$a_0 = \frac{4\pi\varepsilon_0\hbar^2}{\mu e^2} = 0.529 \times 10^{-10}\ \mathrm{m} = 0.529\text{Å} \qquad \text{11-10-2-1}$$

The corresponding probability density function is

$$\Psi * \Psi = \psi^{*}_{nlm_l} e^{\frac{iEnt}{\hbar}}\, \psi_{nlm_l} e^{-\frac{iEnt}{\hbar}}$$

$$= \psi^{*}_{nlm_l}\psi_{nlm_l}$$

$$= R^{*}_{nl}\Theta^{*}_{lm_l}\Phi^{*}_{m_l}R_{nl}\Theta_{\mathrm{lm_l}}\Phi_{m_l} \qquad 11\text{-}10\text{-}2\text{-}2$$

As these are functions of three coordinates, they cannot be directly plotted in two dimensions. Nevertheless, their three-dimensional behavior can be studied by considering separately their dependence on each coordinate. First, the dependence in terms of the radial probability density $P(r)$ is defined such that $P(r)\,dr$ is the probability of finding the electron at any location with radial coordinate between r and $r + dr$, by integrating the probability density $\Psi * \Psi$, which is a probability per unit volume, over the volume enclosed between spheres of radii r and $r + dr$. That is,

$$P_{nl}(r)\,dr = R^{*}_{nl}(r)R_{nl}\,(r)\,4\pi r^2\,dr \qquad 11\text{-}10\text{-}2\text{-}3$$

Figure 11-10-2-1 shows several $P_{nl}\,(r)$ plots, using dimensionless quantities for each axis. A study of Figure 11-10-2-1 will demonstrate that the characteristic radii of these shells are determined primarily by the quantum number n. The expectations value is given by the expression

$$\overline{r_{nl}} = \int_0^\infty rP_{nl}(r)\,dr \qquad 11\text{-}10\text{-}2\text{-}4$$

If the integral is evaluated, this yields

$$\overline{r_{nl}} = \frac{n^2a_0}{Z}\{1 + \frac{1}{2}\,[1 - \frac{l(l+1)}{n^2}]\} \qquad 11\text{-}10\text{-}2\text{-}5$$

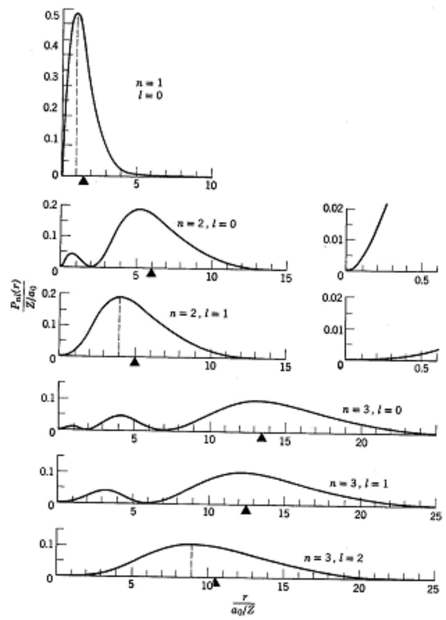


Figure 11-10-2-1

It is apparent that r depends primarily on n. Now the angular dependence of the probability function is

$$\psi^*_{nlm_l}\,\psi_{nlm_l} = R^*_{nl}R_{nl}\Theta^*_{lm_l}\Theta_{lm_l}\Phi^*_{ml}\,\Phi_{m_l} \qquad \text{11-10-2-6}$$

which becomes

$$\Phi^*_{m_l}(\varphi)\Phi_{m_l}(\varphi) = e^{-iml\varphi}e^{-iml\varphi} = 1 \qquad \text{11-10-2-7}$$

and

$$R^*_{nl}(r)\,R_{nl}(r) = \frac{P_{nl}(r)}{4\pi r^2} \qquad \text{11-10-2-8}$$

The form of the factor $\Theta^*_{lm_l}(\theta)\Theta_{lm_l}(\theta)$ can be conveniently presented in terms of a polar diagram, one of which is shown in Figure 11-10-2-2.

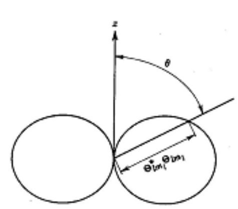


Figure 11-10-2-2

Figure 11-10-2-3 illustrates an example of the dependence of the form $\Theta^*_{lm_l}(\theta)\Theta_{lm_l}(\theta)$ on the quantum number m_l, where $l = 3$. The seven possible values of m_l for this value of l, are $m_l = -3, -2, -1, 0, 1, 2, 3$.

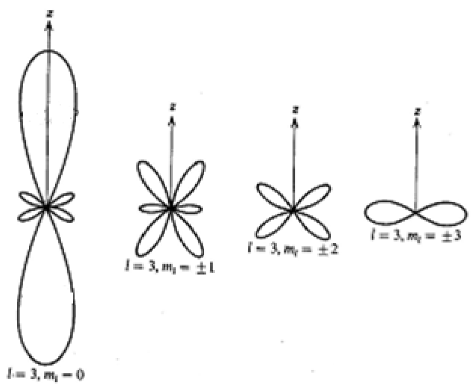


Figure 11-10-2-3

Figure 11-10-2-4 depicts a set of polar diagrams for $m_l = \pm l$ and $l = 0, 1, 2, 3, 4$.

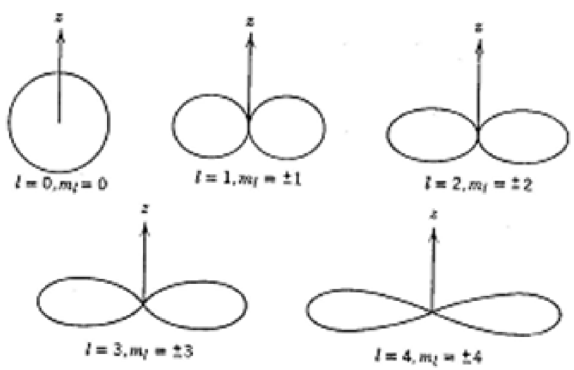


Figure 11-10-2-4

Figure 11-10-2-5 shows an attempt to overcome the limitation of a two-dimensionally printed page using shading to represent the three-dimensional appearance of the probability density function for various states of the one-electron atom.

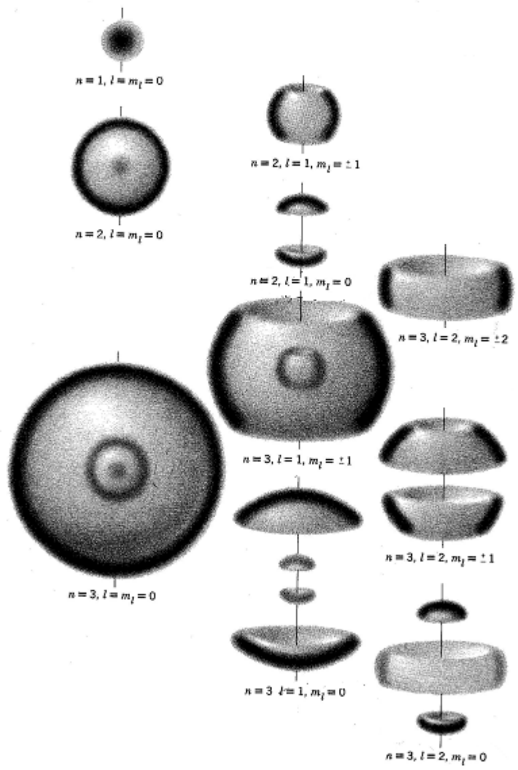
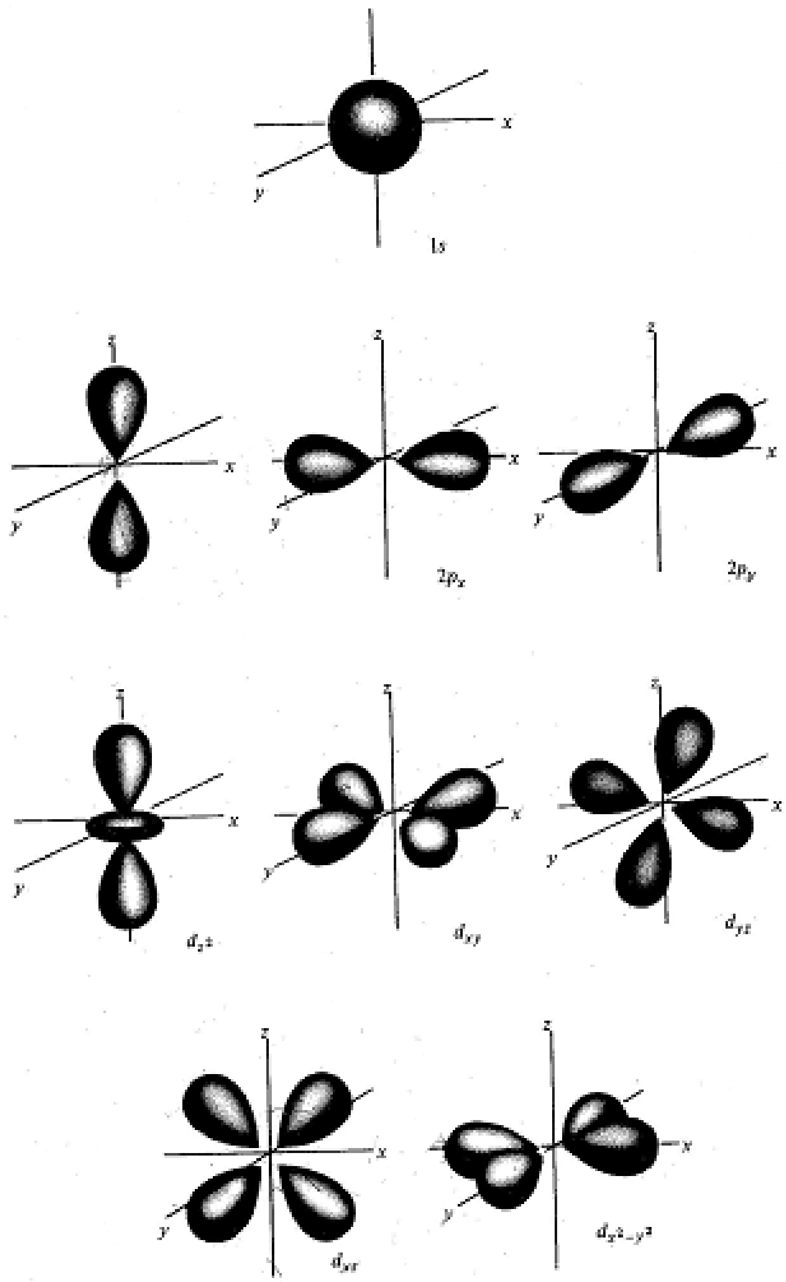


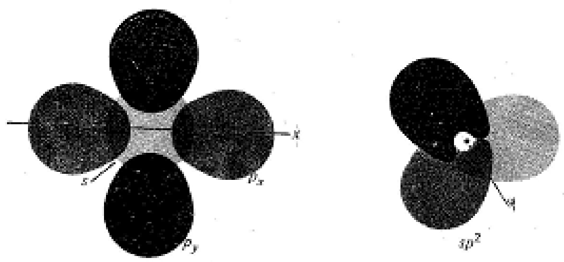
Figure 11-10-2-5

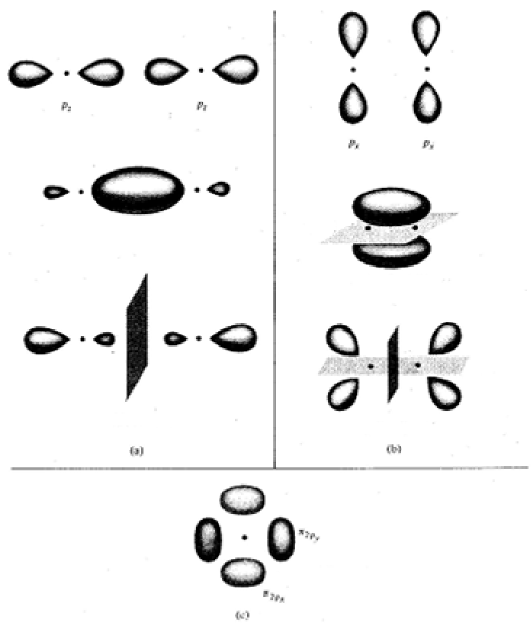
The typical diagrams of the *p* orbital and *d* orbital, the hybrid orbital, and the nuclear pdf are given by Figures 11-10-2-6(A) through 11-10-2-6(C), respectively.



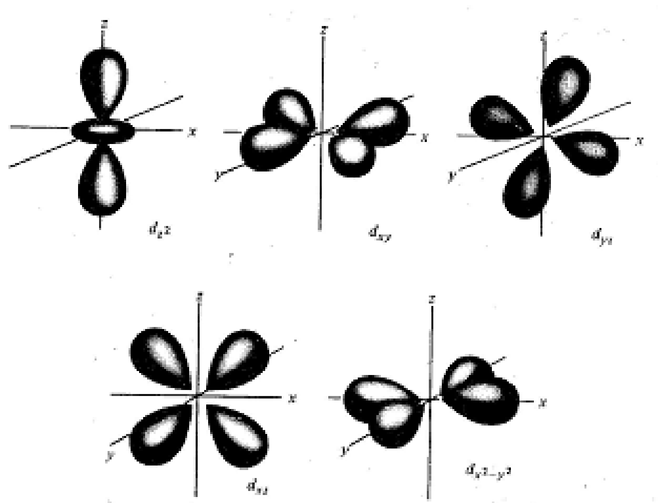
(A)

Figure 11-10-2-6





(B)



(C)

Figure 11-10-2-6 (*continued*)

According to the general correspondence property of CFLE theory about the qualitative similarity of force line elements, such results could be applied universally to any galaxy and any star. But, before we can apply this to galaxy morphology, we need to establish the existing shape of the probability density function according to the spin angular momentum $S = \frac{1}{2}$ and spin magnet momentum $m_s = \frac{1}{2}$. That is,

$g = 2$, $n = 0$, $l = \frac{1}{2}$, $m = 0$, $l = 0$ (Figure 11-10-2-7).

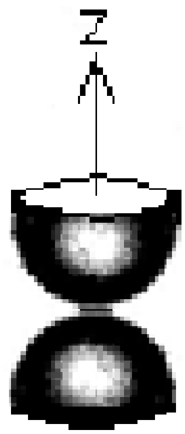


Figure 11-10-2-7

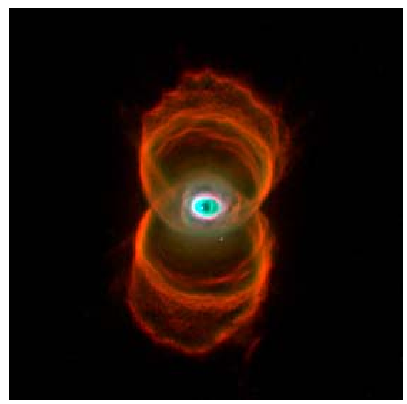


Photo 11-10-2-1 **(Source: NASA/ESA)**

Ordinarily, there is no l_s, but instead S is written because it helps us to imagine the shape of the probability density function $n = 3$, $l = 3$, $m_s = 0$ (Figure 11-10-2-8).

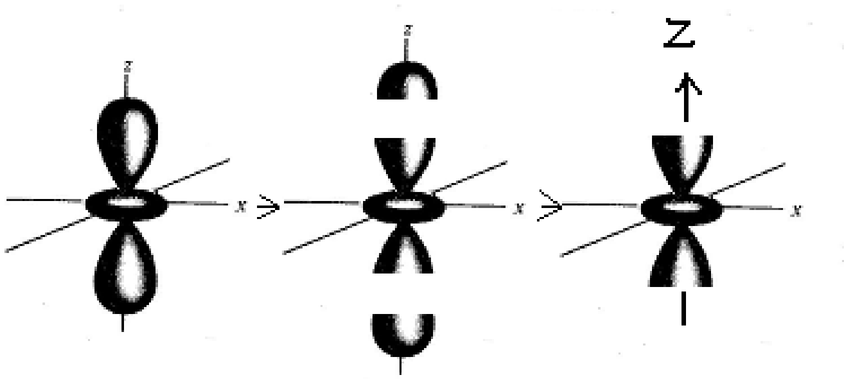
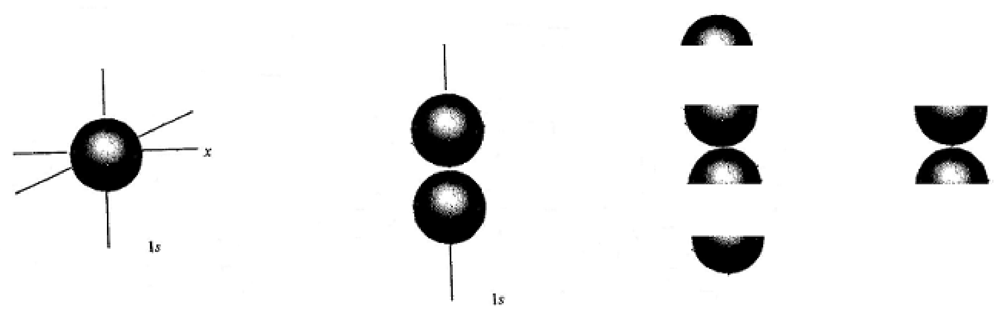


Figure 11-10-2-8

Because of the existence of the spin angular momentum, according to relativity, a specific probability density function has a specific shape, but because the strength of spin angular momentum is

$S = \frac{1}{2}$, or $l_s = \pm\frac{1}{2}$

the possible shapes obtained are as shown in Figure 11-10-2-9.



***l* = 0, m_l = 0** **n = 2, *l* = 1, m_l =0** **$S = \frac{1}{2}$, $m_s = \pm\frac{1}{2}$, *g* = 2, *n* = 0, *l* = 0, $m_l = 0$**

Figure 11-10-2-9

This shape of the probability density function is for the energy state $n = 0$, $g = 2$, $S = \frac{1}{2}$, $m_s = \pm\frac{1}{2}$.

Basically, this shape of the probability density function is very important for the study of galaxy morphology and the morphology of planetary remnants. In the probability density function of electrons of classical electromagnetic theory, there is only one kind of force line. But, because there are 5 kinds of force lines and 5 kinds of force line elements in CFLE theory, there should be 5 kinds of potentials with proper force line curves g, with a proper angle connecting these 5 force lines to one another. Therefore, the shape of the probability density function should be curved with a proper angle.

The first group of galaxies in the classification scheme is the spiral galaxy. This galaxy form has the shape of the probability density function of $l = 1$, $m_l = \pm 1$, $l = 2$, $\mathrm{m}_l = 2$, $l = 3$, $m_l = \pm 3$, $l = 4$, $m_l = \pm 4$ (Figure 11-10-2-10).

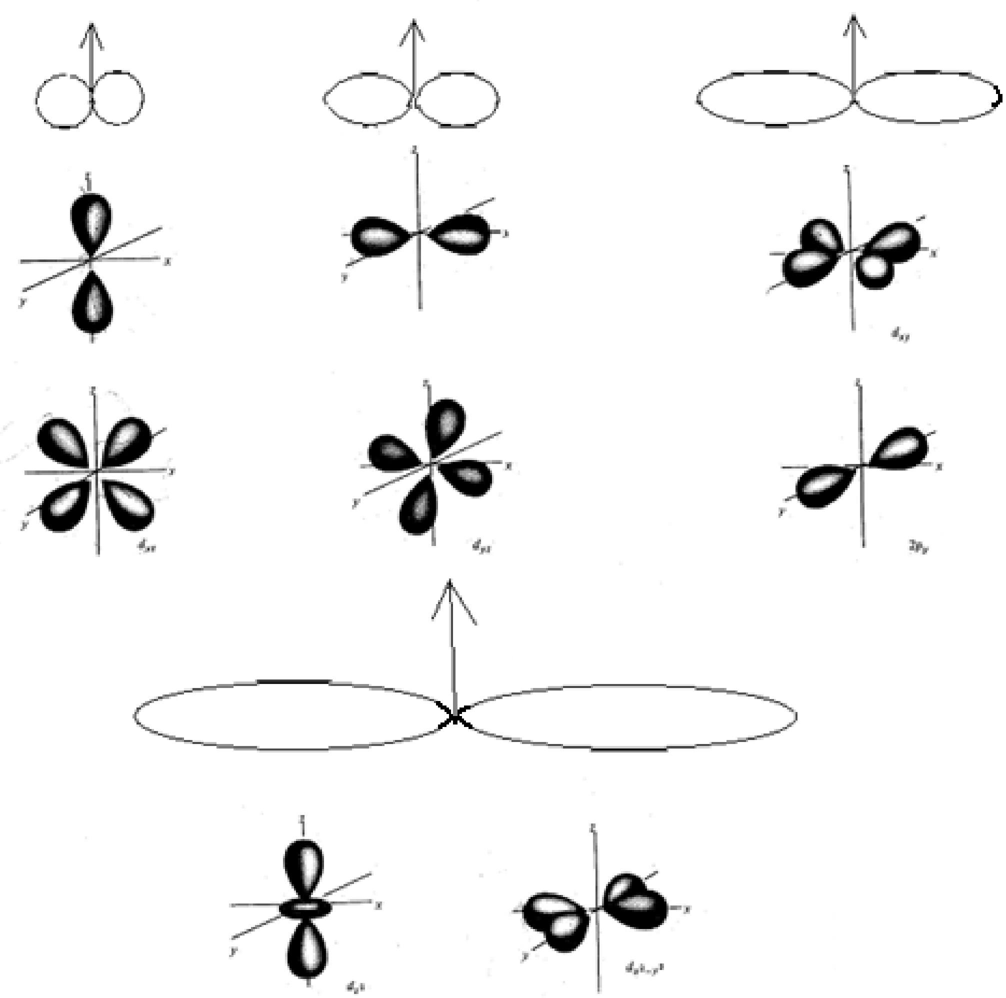


Figure 11-10-2-10

This shape state is formed by only one potential and one field without curve of the force line. However, when considered as a curve of 5 kinds of force lines by force line curve, the shape evolves as shown in Figures 11-10-2-11 and 11-10-2-12 by fourth quantization of galactic field. This means that one particle has wave property and wave can be quanta by second quantization.

Each quantum can be translated curved force line and curved force line can be other quanta as figure 4-2-2-1.

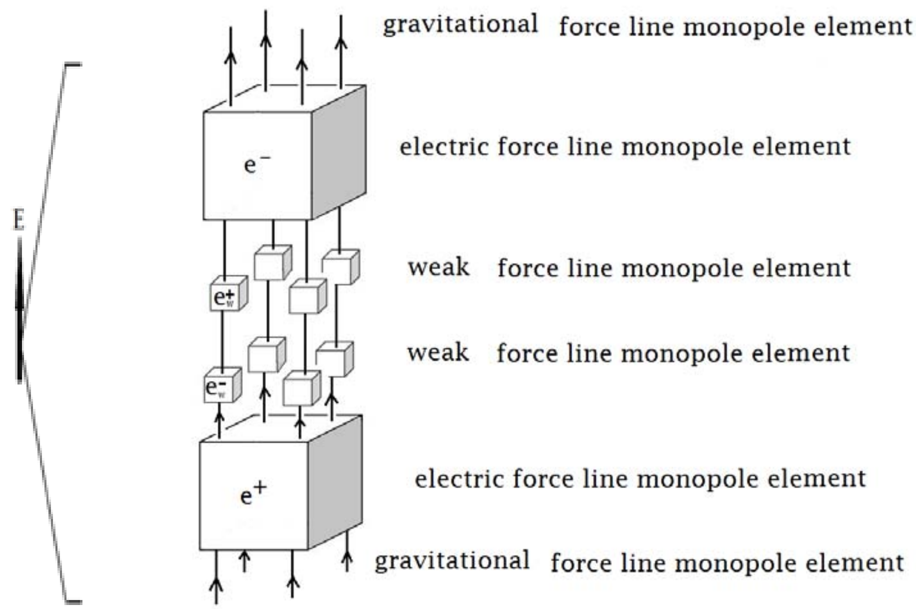


Figure 4-2-2-1

Each other quantum can have probability density function form in curved force line. That is

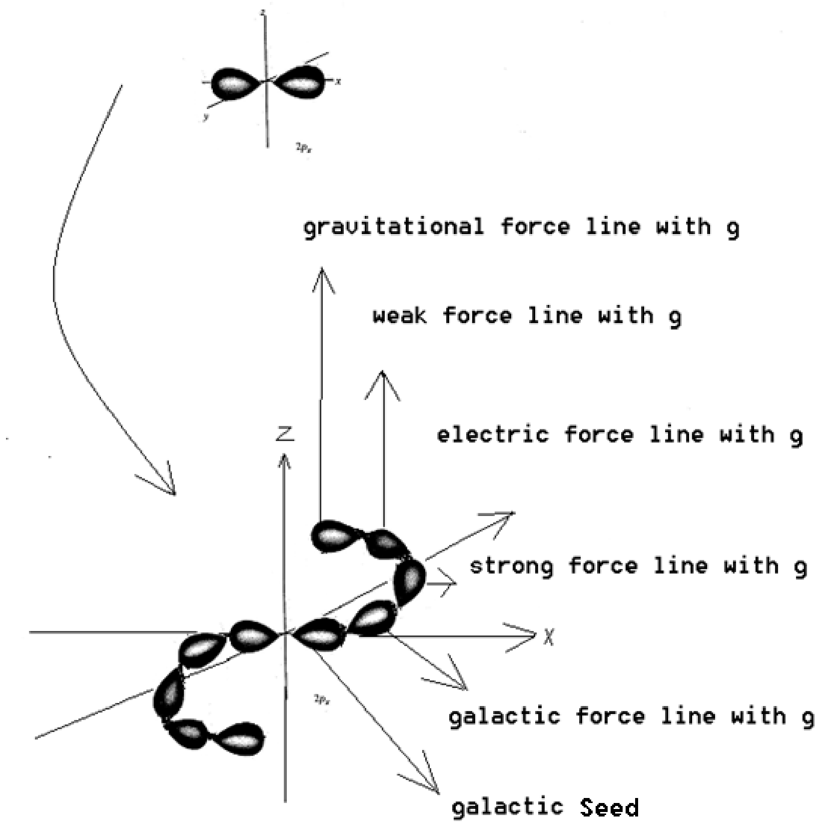


Figure 11-10-2-11 **(Source: NASA/ESA)**

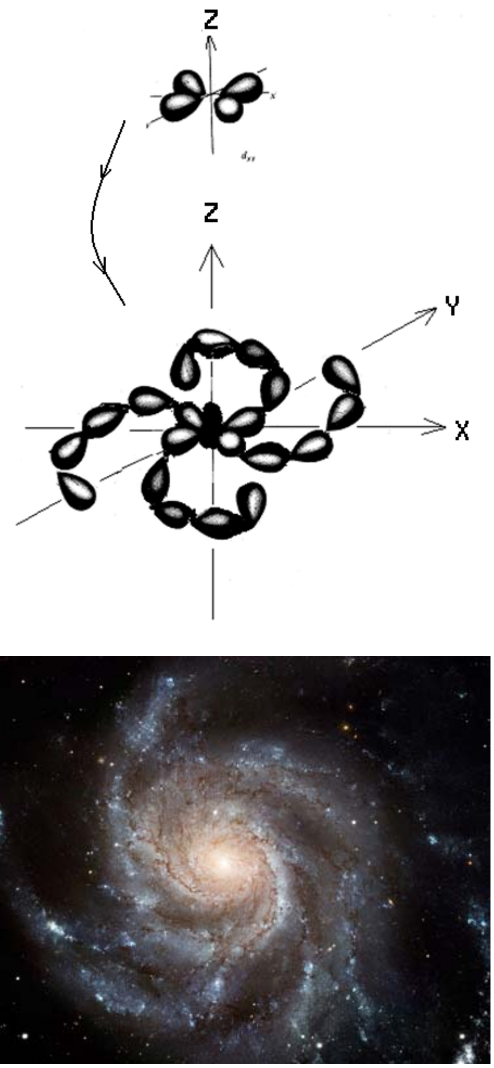


Figure 11-10-2-12 **(Source: NASA/ESA)**

The halo form gives rise to the spherical shape of the probability density function (Figure 11-10-2-13).

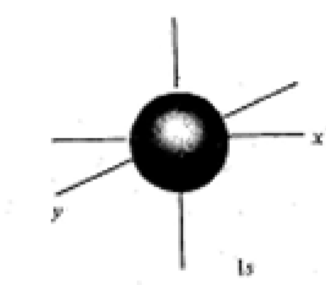
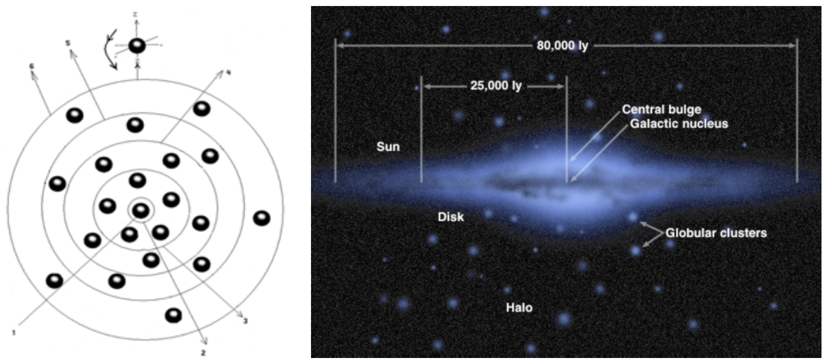
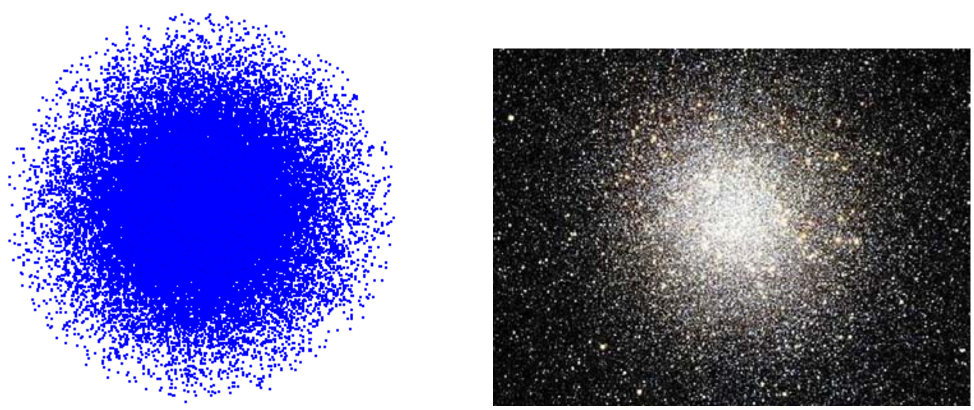


Figure 11-10-2-13 (Probability density function of S)



Probability density functions of halo with 1 seed and 5 kinds of force lines, 2, 3, 4, 5, 6. (Photo source: NASA/ESA)



Probability density function form of Hydrogen(left) and Globular Cluster M22(right) from CFHT .Credit & Copyright**: Jean-Charles Cuillandre (CFHT), Hawaiian Starlight.**

Figure 11-10-2-14.

With 5 kinds of force lines at proper angle to one another, the shape is like that in Figure 11-10-2-14.

Therefore, stellar clusters should exist in the halo as globular clusters. As discussed in §8, the maximum stellar mass number is $A = 347$

Therefore, 347 globular stellar clusters can exist in the halo by galactic force lines, and their possible maximum number of energy states at $g = 2s$ also

N_{globular}= 347/2=174 11-10-2-9

The observed value of the globular cluster is

$N_{\text{globular}} = 180\pm20$ 11-10-2-10.

Here, the important point is that the stellar distribution of globular clusters and halos of galaxies along the shape of the probability density function provide direct evidence that astronomical objects can have wave nature too.

In other word, star is visible result of fourth quantization of galactro magnetic field by quantum galactro dynamics (QGD) of CFLE theory, because energy quantum of the galactro magnetic field $\hbar_{galaxy}$ is tremendously huge.

Now, when two such shapes of probability density functions are overlapped, they become the typical spiral galaxy form shown in Figure 11-10-2-15.

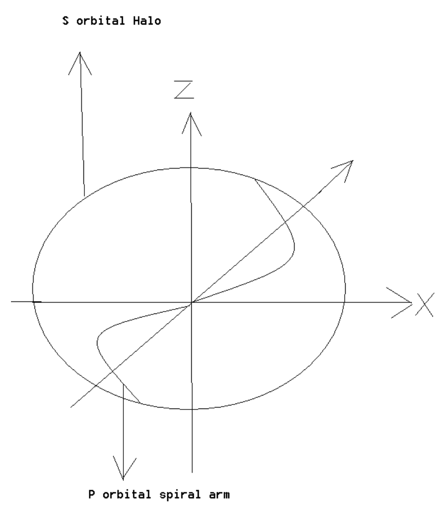


Figure 11-10-2-15

The typical shape of the bulge is an ellipse, which originates from the quadrupole moment of the charge distribution of the galactic charge that corresponds to the nuclear quadrupole moment (see Figure 11-10-2-16).

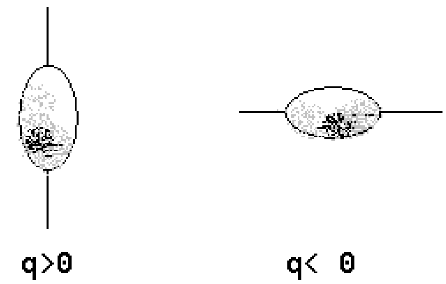


Figure 11-12-2-16

In the galactic center with curve by force line curve *g*, we obtain the shapes in Figure 11-10-2-17.

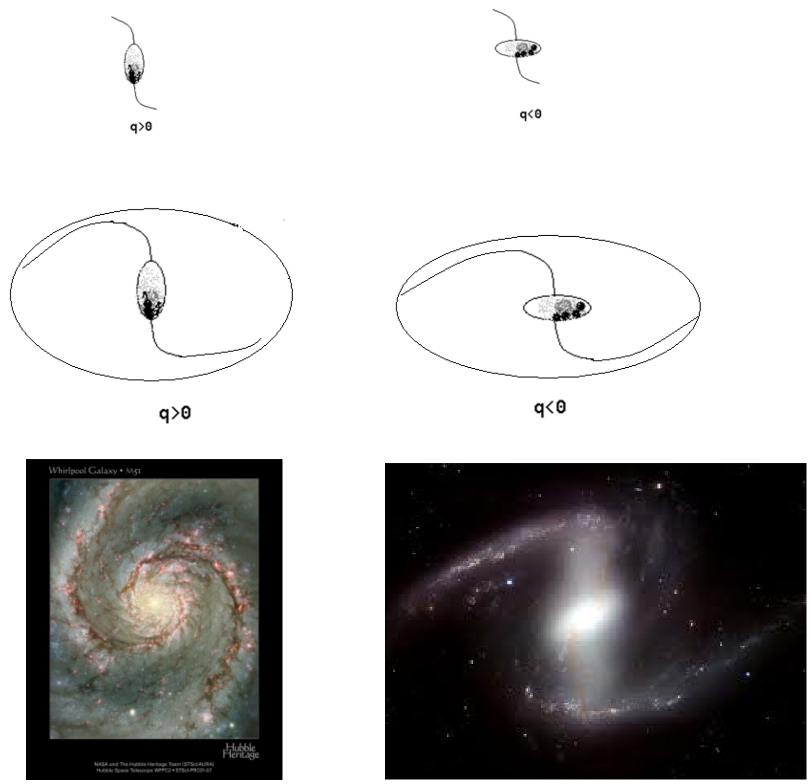


Figure 11-10-2-17 **(Photo source: NASA/ESA)**

Let us look specifically at each galaxy shape, starting with the lenticular-shaped galaxy. This group originates from the orbital functions

$n = 2$, $l = 1$, $m_l = 1$, $n = 2$, $l = 1$, $m_l = -1$ (see Figure 11-10-2-18).

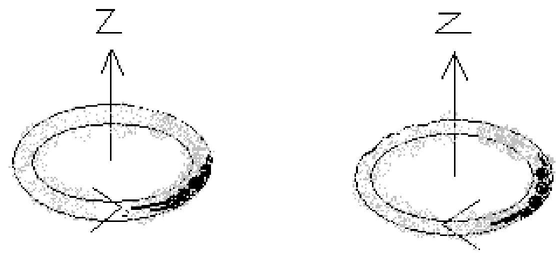


Figure 11-10-2-18

How do we know the star system occurred from these orbital functions? Firstly, we know that these orbital functions exist; secondly, the galactic cloud fulfilled these orbital functions; thirdly, the star system is formed in this shape of orbital function according to stellar probability density function. The shape of this galaxy and star is depicted in Figure 11-10-2-19.

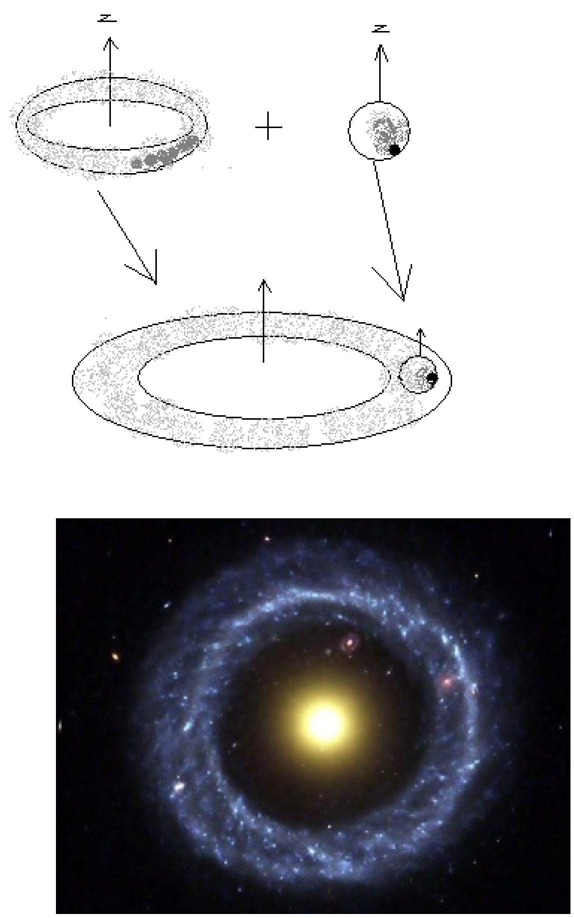


Figure 11-10-2-19 (Photo source: NASA/ESA)

The second group of galaxy shapes is the barred spiral galaxy. The shape of this galaxy results from combining the orbital functions ($l = 1$, $m_l = -1$) and ($l = 2$, $m_l = +2$).

Combination phase 1 is shown in Figure 11-10-2-20-1.

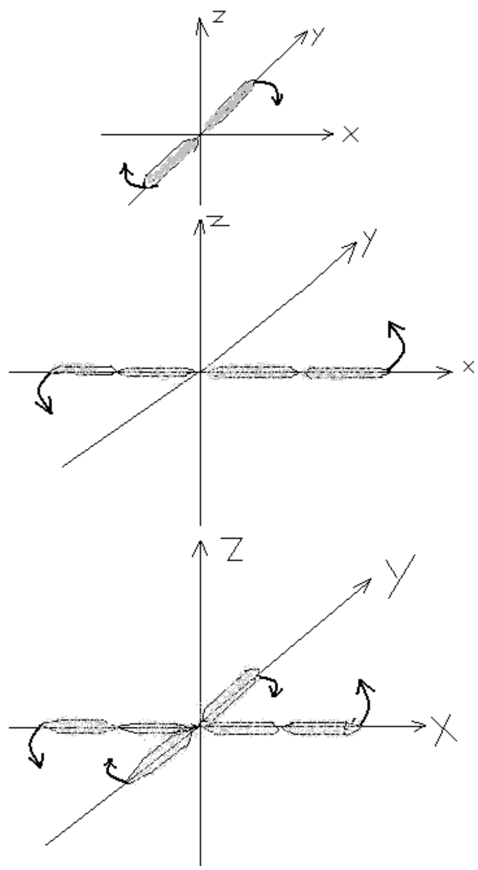


Figure 11-10-2-20-1

Combinations phase 2 is shown in Figure 11-10-2-20-2.

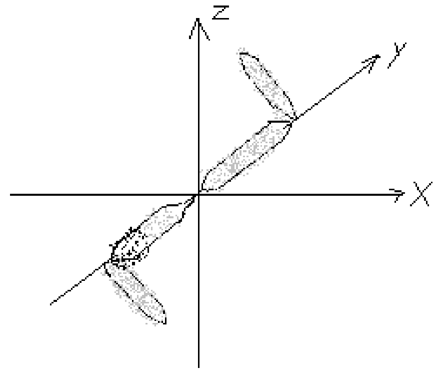


Figure 11-10-2-20-2

This result is applied to the galaxy (Figure 11-10-21), and combination phases 1 and 2 are shown in Figure 11-10-2-22.

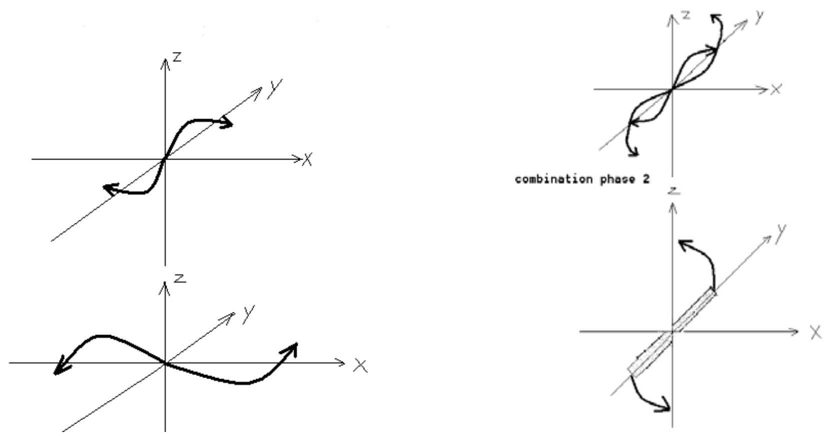


Figure 11-10-2-21

Figure 11-10-2-22 **(Photo source: NASA/ESA)**

Because in the combination phase 2 each component lost its curve of force line by offset of the anti direction of the force line curve g, the force line structure appears flat.

The third group of galaxy shapes is the ellipse-forming galaxy. The original combined orbital function follows first only $n = 1, 2, 3, 4$, $l = 0$, $m_l = 0$.

The shape of the spherical form of this orbital function is given in Figure 11-10-2-23.

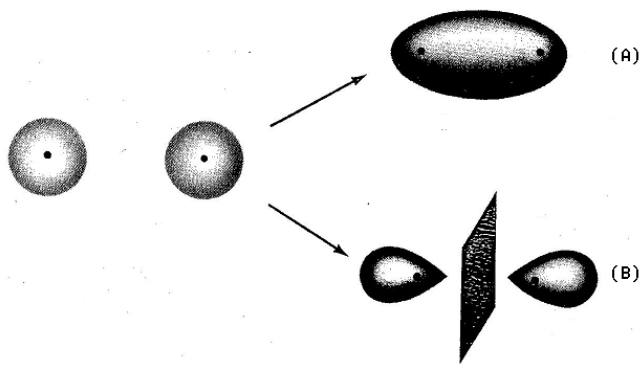
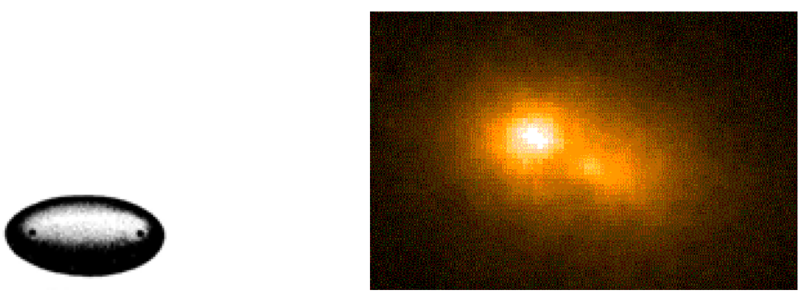


Figure 11-10-2-23



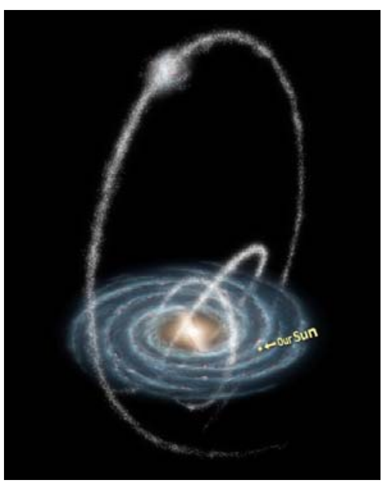
The Double Nucleus of M31
Credit: T. R. Lauer (KPNO/NOAO) et al., HST

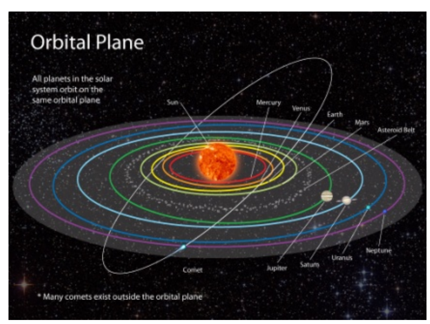
Figure 11-10-2-24 **(Photo source: NASA/ESA)**

Like the H_2 molecule, however, these spherical forms combined and formed the ellipse forming orbital function (Figure 11-10-2-24). Therefore, two cores can exist in an ellipse galaxy.

The last group of galaxy shapes is the irregular-shaped galaxy. This irregular shape of orbital functions represents the moment of shape formation during galaxy evolution and reformation after a galactic explosion, like a second generated star after a supernova explosion. Because, during the phase of an irregular galaxy, the galaxy core is absorbing the intergalactic cloud to fulfill the probability density function, their form looks irregular. For this reason, a distant galaxy's red shift is z = 6~7~8, and is observed as a strange-shaped galaxy. This observation means that the origin of an irregular shape is that of a galaxy forming during the evolutions phase in the history of galaxy syntheses. Finally, the adverting spiral arm, which expresses directly the curved force line in the shape of a spiral galaxy, gives obvious direct assurance for the CFLE theory in describing the universe.

Boundary of Galactic disk and halo correspond solar optical surface or proton charge radius. Out of such region at $g = 2$ starts sun's planet and proton's electron. According to correspondence principle of CFLE theory galaxy should have such correspondent objects for galaxy system to build as planets in solar system and as electrons in atom system. Those are dwarf galaxies. Our Milky Way has more than 20 dwarf galaxies and only 11 dwarfs orbiting the Milky Way it, theoretically 500 MW dwarfs are expected.





Canis Major Dwarf Galaxy **Jupiter**

Milky Way system **Solar system**

Figure 11-10-2-25

11.11 Applying Schrödinger’s Equation to Macro Worlds

In the previous chapter, I attempted to apply Schrödinger’s equation to macro physical objects like the galaxy. Recall that Schrödinger’s equation has universality, because the wave of his wave equation, as a physical entity (as De Broglie suggested), has universal property as a material field and material force line, which M. Faraday introduced as an electric force line. Therefore, it can be expected that the applications range of Schrödinger’s equation can be extended to the cosmic scale.

11.12 Solving Origin Problem of Astrophysical Jets

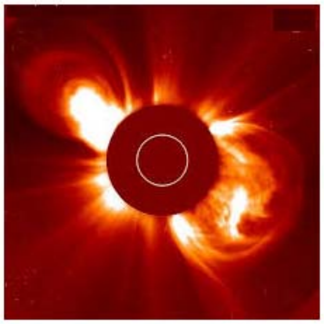
11.12.1 Solving Origin of Relativistic Jet from Active Galactic Nucleus as Galactic Mass Ejection

Resent astronomy and astrophysics cannot explain why do the accretion disks surrounding certain astronomical objects, such as the nuclei of active galaxies, emit relativistic jet along their polar axes.

However, CFLE theory can explain this phenomenon by inertial law with force line (fine explained in §15).

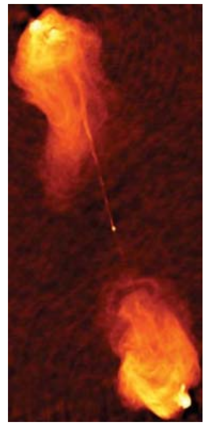
Simply saying, origin of all of astrophysical relativistic Jet and Beam from active galactic nuclei(AGN), pulsar, and neutron star has same physical reason as solar corona mass ejection at solar activity by inertia of force line(cf.§15). Corona mass ejection (CME) shape is normal as Figure 11-12-1-1-left.

However, galactic mass ejection’s shape is narrow beam shape as Figure 11-12-1-1-right.



Solar CME

2000.11.08.23:26

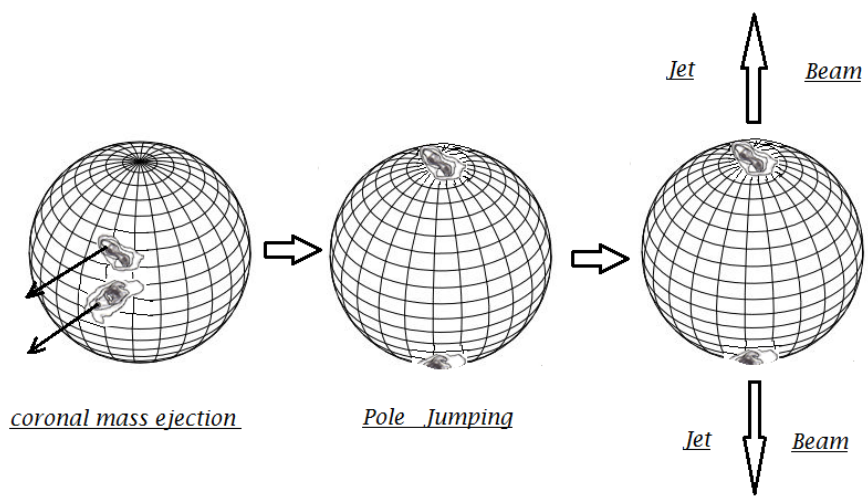


Active nulcleus of 3C405

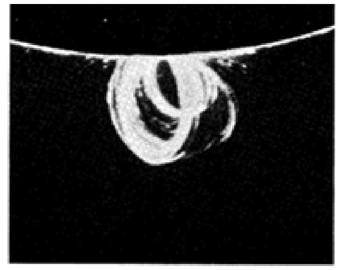
AUI Perley et al 1984

Figure 11-12-1-1

Under strong gravitational magnetic field of galactic nucleus and neutron star from XY plain, inertial pole jumped (cf.§15) from equator region to pole region as Figure 11-12-1-2.



Equatorial ejection: CME



Polar ejection: Jet

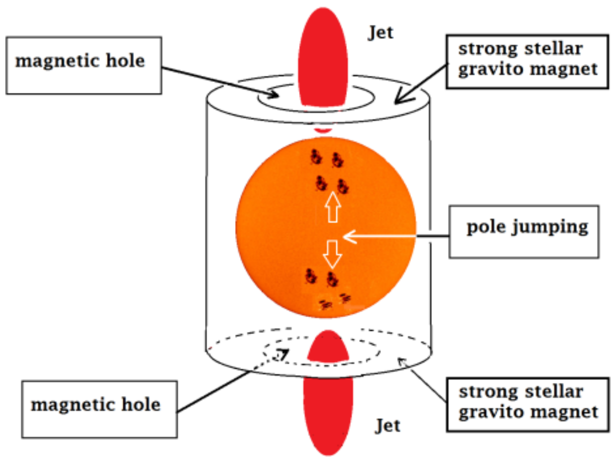


Figure 11-12-1-2

And by strong main pole magnetic field from strong gravitation Jets or Beam is restricted only $\pm z$ pole as Figure 12-12-1-3

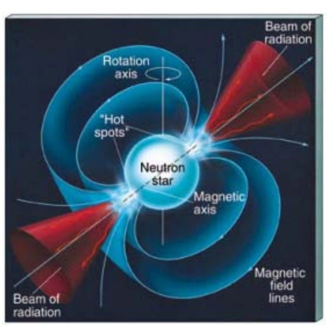
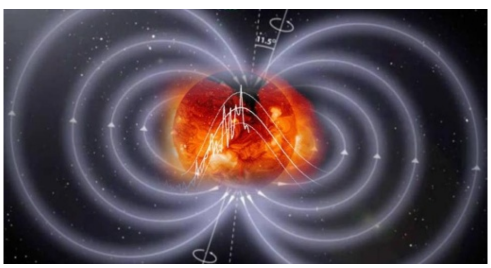


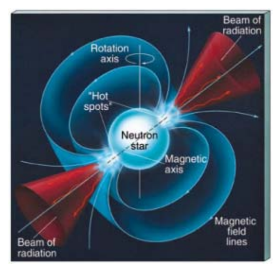
Figure 11-12-1-3

The pulsar's pulsating correspond quiet and active sun's radio emission and mass ejection of the $\pm z$ direction only, because of strong gravitation of XY plain "as of 2010, they are the most magnetic objects ever detected in the universe. As described in the February 2003 *Scientific American* cover story, remarkable things happen within a magnetic field of magnetar strength. "X-ray photons readily split in two or merge together. The vacuum itself is polarized, becoming strongly birefringent, like a calcite crystal. Atoms are deformed into long cylinders thinner than the quantum-relativistic de Broglie wavelength of an electron." In a field of about 10^5 teslas atomic orbitals deform into rod shapes. At 10^{10} teslas, a hydrogen atom becomes a spindle 200 times narrower than its normal diameter." and escape velocity is half of light speed (cf.§15.8.2)

Therefore,we can predict that pulsar beam and AGN's beam that should have main pulse and inter pulse, because such pulse correspond radiation of active Sun and radiate from quiet Sun.



Usual stellar magnet



usual pulsar magnet

Sun's CME

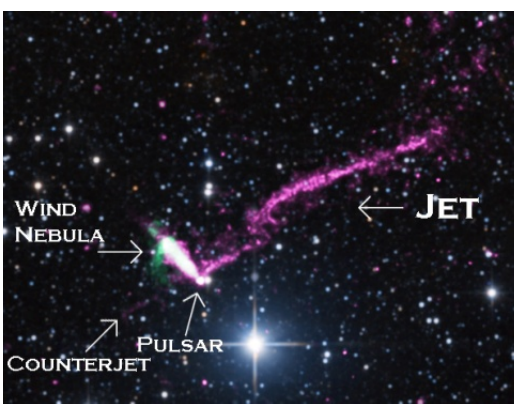
illustration of the pulsar beam

PSR 1745- 2900

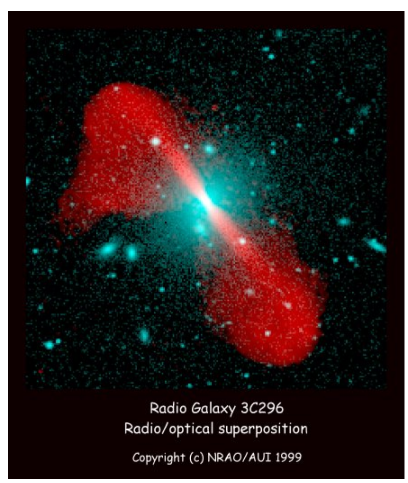
Figure 11-12-1-4

The quasar 4C+21.35(1222+216:Z=0.435) is one of the most intriguing of the extreme active galactic nuclei (AGN) known as "blazers". The central black hole (BH) has a mass of $6\times 10^{8} M_{\odot}$(Farina et al 2012). BH is surrounded by an accretion disk with a luminosity of $5\times 10^{46} ergs^{-1}$.on parsec scale the quasar has a very compact core with extended structure directed to north. The jet is highly relativistic with an apparent speed up to 26.6 c (Lister et al 2013). Therefore such phenomena correspond beam of neutron star. In surface of nucleus atom is gravitationally pressure by galactic nucleus and is neutronized as neutronic pulsar. Aharoniar (2002) obtained the acceleration power for proton of $L_p \simeq 10^{46} ergs^{-1}$ to explain the optical X-ray spectrum of knot A in 3C273 in term of proton synchrotron radiation. The energy density of electron exceeds that of magnetic field $B = 5\mu G$ as roughly corresponding to an equipartition condition, they obtain a jet kinetic power of $L_{jet} \simeq 1\times 10^{48} ergs^{-1}$.they get results from Spitzer IRAC observation of the 3c273 at wave length 3.6 and 5.8 μm.two distinct radiation components, namely low energy and high energy emission, have similar power of $\sim 10^{44} ergs^{-1}$ for the entire jet volume.

Another possible source is galactomic neutron that is dense as neutron star and pulsar. They last relativistic jet but energy scale is $10^{65} ergs^{-1} \sim 10^{68} ergs^{-1}$



Neutron star jet



Quasar jet

Figure 11-12-1-5

As discussed in §8, when a star's energy state is not stable, it will decay according to the order of the energy scale, namely, nuclear fission (supernova), α-decay (nova), β-decay (variable star), and γ-decay (planetary nebular). Because CFLE theory assumes qualitative and quantitative similarity of force lines among all systems, it is expected that the same phenomena will occur in the galaxy system. A good example is in the galaxy cluster Ms 0735, 6+7421, observed by the Chandra space telescope. The constellation is Camelopardalis, with a distance of 2.6 billion light years and declination 74° 14′ 51″. This powerful eruption, since the Big-Bang apparently had occurred there, can be said to be one of galaxy decay. Within the cluster was discovered a pair of giant cavities, each nearly 200 Kpc in diameter.The eruption shock energy was $\sim 10^{55}$ J, which is the most powerful radio outburst known. This energy level is much larger than the usual stellar decay energy level of $\sim 10^{46}$ J. Because CFLE theory uses the energy factor of a galaxy

$$F_g = F\,(1.190208 \times 10^7)^2 = 10^{14} \qquad 11\text{-}12\text{-}1$$

This theory can distinguish any phenomena that occur by stars or by galaxies. Therefore, the decay energy scale of a galaxy is expected to be

$$E_{Gal} = (10^{44} \sim 10^{47}\text{J})\,(10^{14}) = 10^{58} \sim 10^{61}\text{J} \qquad 11\text{-}12\text{-}2$$

The possible mass ejection exits are given +Z and –Z directions from inside of a given transformed probability density function. Figure 11-14-1 shows the possible exit outcomes when given the case of a combined probability density function by inertial pole Jumping.

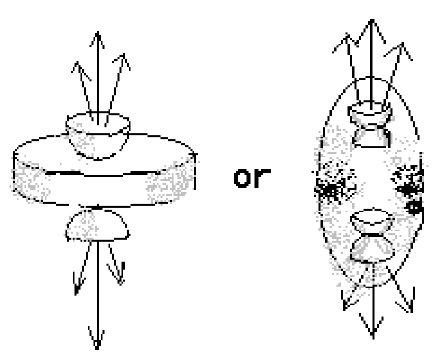
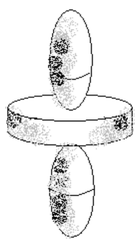


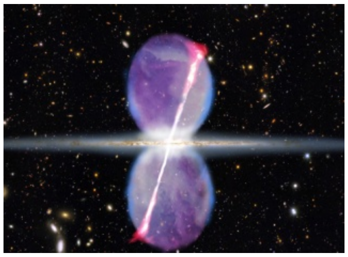
Figure 11-12-1-6

Photo 11-12-1- (Source: NASA/ESA)

Because galactic nuclear decay can sometimes occur in the core of a galaxy (inside of a bulge), the energy is emitted to the outside of the boundary much like beam of pulsar of neutron star.

When the nuclear decay of a galaxy is the same as the quantum state of a supernova, its shape takes on that of the stellar probability density function. Usually, when observed with visible light, the shape of the orbital function of a star does not always appear, but with high-energy microwave (e.g., x-ray) observation, the shape of the orbital function in the supernova remnant becomes apparent, an example being the Crabs supernova remnant. Likewise, a very high-energy galactic nuclear decay like galactic cluster MS0735.6+7421 has the same qualitative shape of the transformed probability density function of any stellar orbital function under x-ray observation (Figure 11-12-3).





The faint jets we see today are a ghost or after-image of what existed a million years ago,' by an astronomer at the Harvard-Smithsonian Center for Astrophysics Meng Su', after the Fermi Space Telescope detected traces of the blasts.

Figure 11-12-1-7

Photo 11-12-1. Gamma ray bubble taken by Fermi gamma ray space telescope (Source: Courtesy NASA/ESA)

In this phenomenon, we expect to have galactromagnetic wave radiation. Such galactromagnetic waves made by galactic force lines and their force line elements correspond to electromagnetic waves. Therefore, aside from visible light observations, high-energy wave x-rays and γ-rays are important for observing and studying galactic nuclear decay. Such tremendous galactic gas clouds can be called galactic remnants. However, because current astrophysics has yet to have study fields for galactic remnants and galactic core remnants, we cannot expect much to be explained about these phenomena.

11.12.2 Solving Shape Mystery of Planetary Nebulae

In the collapse of Bose-Einstein condensate (fine explain cf.§19) occur

implosion into another low energy level of curved frame of reference.

During such process each bosonic component particles arrive each energy level with same transient spin at same time collectively. Therefore, such component particles that have same transient spin; have to fallow Pauli's exclusion's principle collectively. That is reason of explosion of Bose-Einstein condensate. By same reason explode supernovae and novae.

However, during the implosion each component particles have to experience various energy levels collectively, results of explosion has to appear according to various energy levels.

Each energy level has each probability density function form as Figure 11-12-2-1. Therefore, each supernovae remnant and planetary nebulae that are results of implosion and explosion of stellar collapse of Bose-Einstein condensate, has to have various shapes of probability density function form at same time.

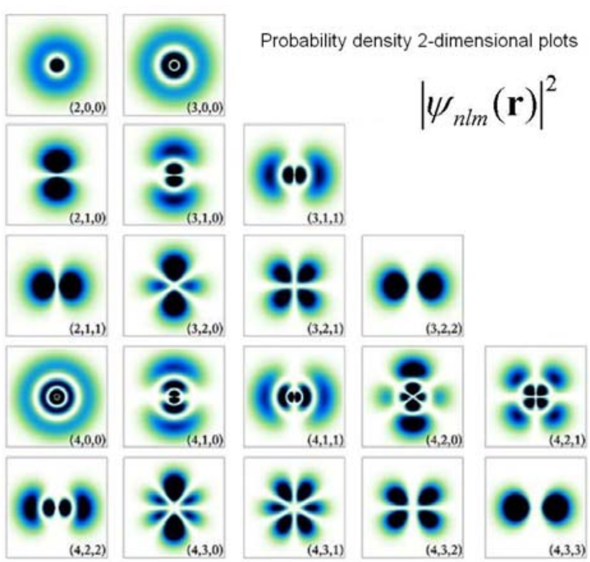
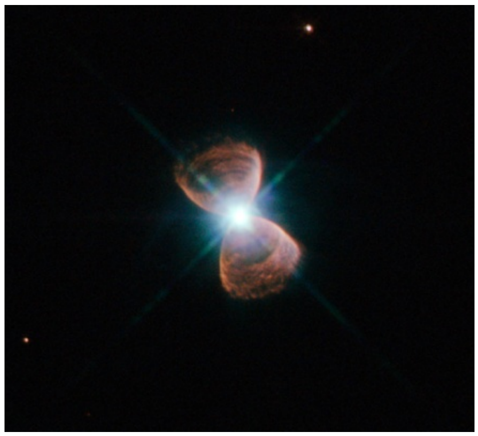


Figure 11-12-2-1

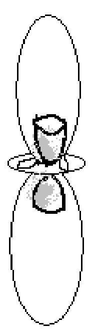
In the case of planetary nebula, the stellar decay corresponds to explosion by collapse of Bose-Einstein condensate, and the same shape of the probability density function appears for both. The first basic appearance occurs at $n = 0$, $g = 2$, $m_l = 0$, $l = 0$, $S = \frac{1}{2}$, $m_l = \frac{1}{2}$. Figure 11-12-2-2 gives the shape of this probability density function.

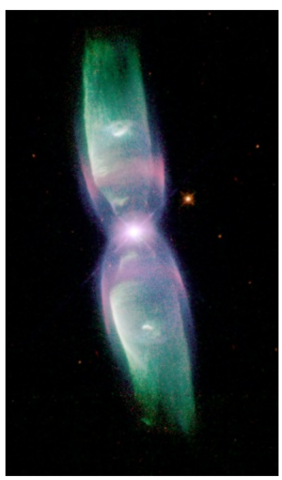


PN Hb 12

Figure 11-12-2-2

Secondly, the appearance of $n = 3, 4$, $m = 0$ and in combination with $g = 2$, $n = 0$, $m = 0$, $l = 0$, $S = \frac{1}{2}$, $m_l = \frac{1}{2}$ gives the density shape of this probability function shown in Figure 11-14-5.

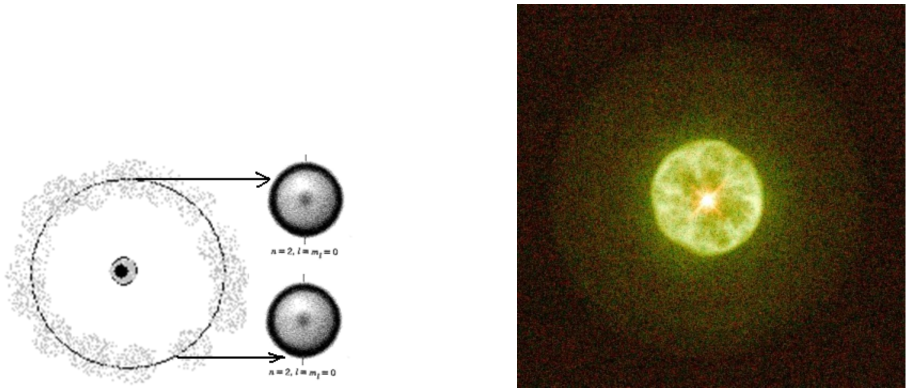




M2 -9

Figure 11-12-2-3

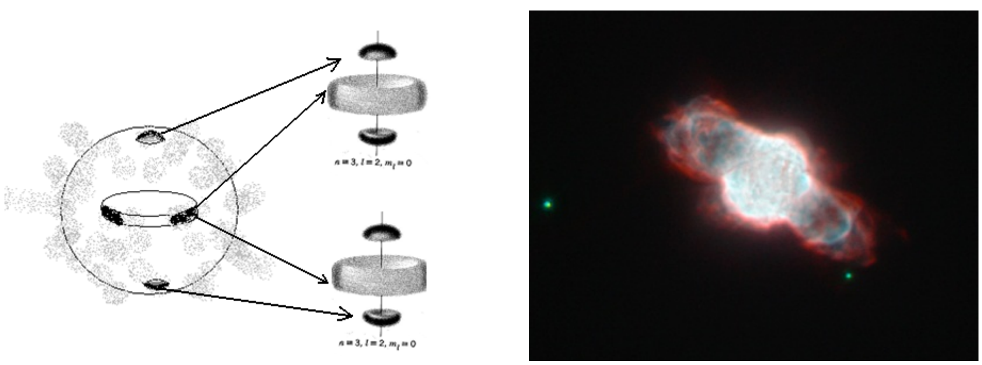
Thirdly, the function n =1, 2, 3, 4, l = 0, m = 0 gives the density shape of this probability function shown in Figure 11-12-2-4.



Lemon slice Nebula IC 3568

Figure 11-12-2-4

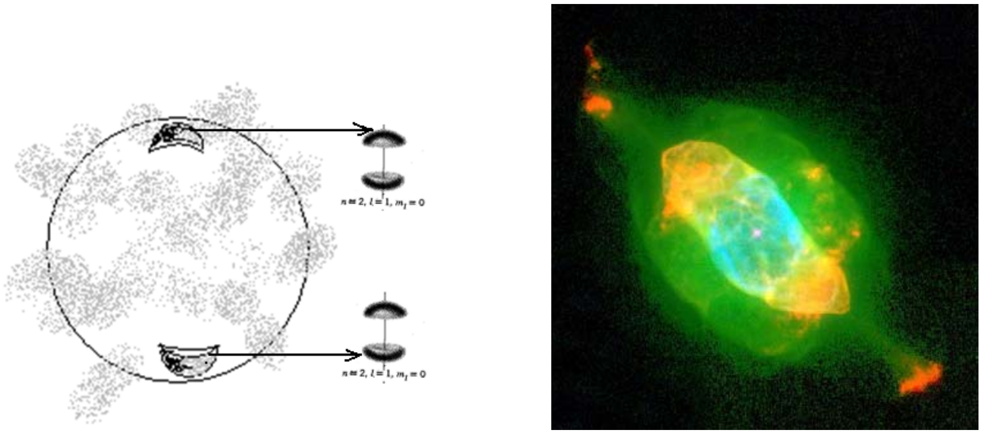
Fourthly, Figure 11-14-7 shows the shape for n = 3, l = 2, m = 0, in combination with n = 2, m = 0, l = 0.



NGC 6886

Figure 11-12-2-5

Fifthly, n = 2, l = 1, m_l = 0, in combination with n = 3, l = 0, m = 0 gives the shape shown in Figure 11-12-2-6.



NGC 7009

Figure 11-12-2-6

Sixthly, $n = 3$, $l = 1$, $m_l = 0$, in combination with $n = 4$, $m = 0$, $l = 0$, gives the shape shown in Figure 11-12-2-7.

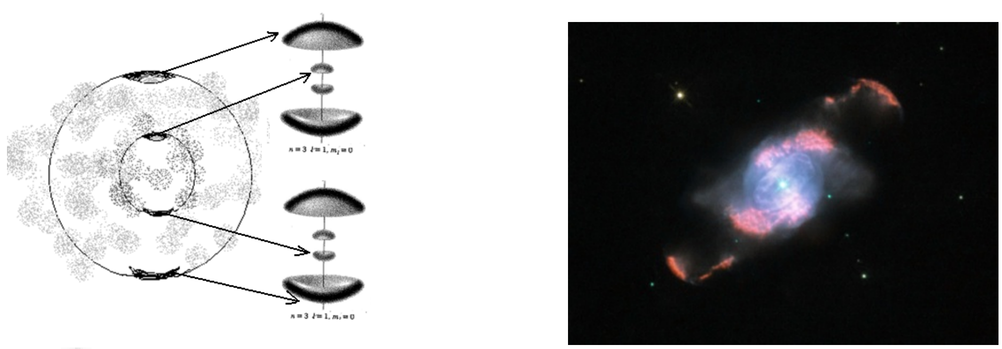


Figure 11-12-2-7

Lastly mixing shape of planetary nebulae such as figure 12-12-2-8 figure 12-12-2-9can always decompose various unit proper probability density function form(PDFF).

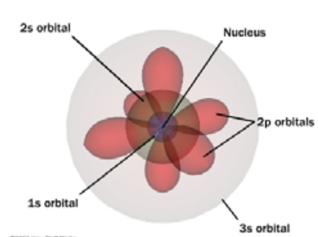
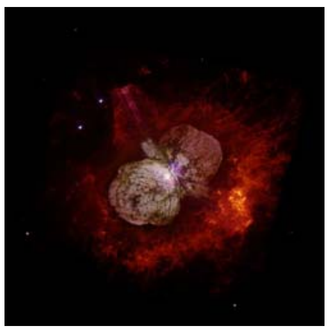


Figure 11-12-2-8

Cat's eye Nebula

He 2-47

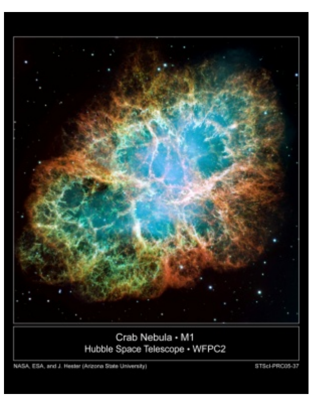


ηCarinae

NGC 6543

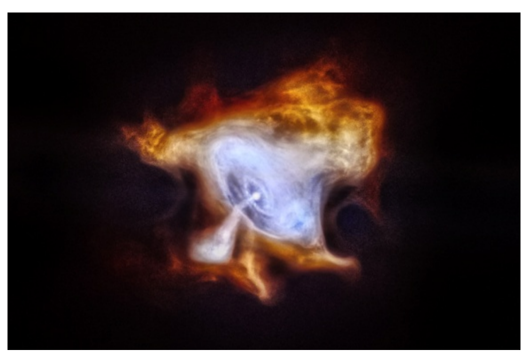
Figure 11-12-2-9

Even crabs supernova remnant that is exploding continue, has shape of PDFF. With visible light that has no shape of FDFF. But by X-ray observation we can find shape of FDFF as right of figure 12-12-2-10.



SN 1054

Crabs nebula: light



SN1054

Crabs nebula: X-ray

Figure 11-12-2-10

In their supernova remnants and novas, the shape of variable stars should exist as the shape of their probability density functions, since according to the correspondence principle, all force lines and their force line elements are qualitatively the same (Figure 11-14-10).

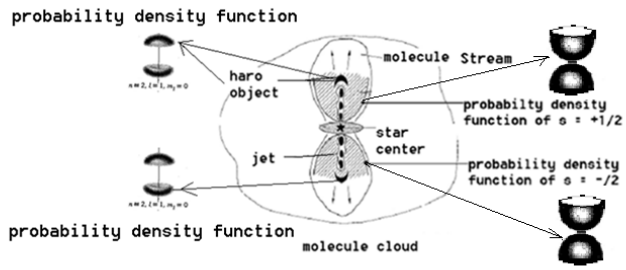


Figure 11-12-2-11

In future studies about galactic nuclear decay, such shapes of galactic orbital functions are expected to be found.

11.13 Applying CFLE Theory to Quasars as AGN

11.13.1 Solving the Identity of Quasars by CFLE theory

On 26 September 1960, astronomers Thomas Matthews and Allan Sandge prepared to use the 200 inch telescope at Mt. Palomar in California to make some observations of the radio source denoted 3C48 (the 48th entry in the third “ Cambridge catalogue” of radio sources). They were interested in what kind of visible light this source might be emitting. They took a photographic plate of the area of sky around 3C48, and conventional wisdom at that time told them that they would find a cluster of galaxies at the location of the radio source. But this was nothing like what they saw. Instead, as far as anyone could tell by looking at the photographic plate, the object was a star, and yet it was like no other star seen up to then. Subsequent observation during October and November of the year and periodically throughout 1961 showed that its spectrum of color was highly unusual, and that its brightness or luminosity varied widely and rapidly, sometimes over a period as brief as fifteen minutes. This was a new addition to the astronomical family and it needed a special name. It was a radio source, yet it looked “stellar” or star-like. On the other hand, because of its spectrum and variability it was not quite a star. It was only “quasi” stellar, hence the name “quasi-stellar radio source” or quasar was applied to this object and to others like it.

The discovery of the quasar thrust general relativity immediately to the forefront of astronomy. The reason was an energy crisis of truly cosmic proportions, and within a few years after the discovery of the quasar associated with 3C48, it was found that it and other quasars like it were among the most distant objects in the universe. What the astronomers thought were unusual spectra were actually rather ordinary spectra in which all feature were shifted uniformly to the red end of the spectrum. This meant that the quasar must be moving away from Earth at high speed—in fact, 30% of the speed of light. In the case of 3C48, one-third of the light speed corresponded to a distance of about 6 billion light years. Because the quasars were so distant, one would have expected them to be faint, and yet they were very bright sources of both invisible light and radio waves, and therefore their intrinsic brightness luminosity must be enormous. For 3C48, that number translated into 100 times the brightness of our galaxy. This was the energy crisis. The problem became what the possible source of such power could be.

On a cosmic scale, the strongest known force is gravity, so it was suggested that the energy of a super-strong gravitational field could provide the answer. Furthermore, the source of this power had to be very compact, for the simple reason that for the source to vary in brightness coherently over a period of (say) one hour, one side of the source has to know what the other side is doing and thus behave in unison. Therefore one solution to the quasar energy crisis involved strong gravitational fields, meaning perhaps a huge concentration of mass, maybe millions of times the mass of the sun, being confined to an object in the orbit of Jupiter. This represented a new collapsed state of matter that could only be described by the general theory of relativity.

The discovery of quasars created a new field of physics. In June 1963, invitations were sent out to astronomers, physicists, and mathematicians around the world to attend a conference on this new discipline, to be called relativistic astrophysics. The first symposium on relativistic astrophysics was held at Dallas, Texas on 16–18 December 1963 with some 300 scientists in attendance. Within a few years, the discoveries of the cosmic fire ball radiation (1965), pulsars (1967), and an x-ray source were made, and yet the nature of quasars ironically still remained a mystery after 20 years. In December 1978, the ninth Texas symposium on relativistic astrophysics was held for the first time outside the USA and attracted over 800 participants to Munich, Germany.

Despite more than 30 years of intensive observation and theoretical analyses, the nature of quasar remains somewhat of a mystery. The only powerhouse of a quasar was believed to be the active and violent central nucleus of a galaxy, and a typical quasar involved a super-massive core, weighing at perhaps 100 million solar masses, at the center of the galactic nucleus (as large as this is, it may still be only 1/1000 the total mass of the galaxy). Unavoidably surprisingly, the physical processes involving hot gases, whirling stars, and intense radiation in the nucleus of a galaxy are so messy that it will be impossible to learn anything precise about general relativity in quasars.

But CFLE theory and charge screening theory can affirm about quasars qualitatively; that is, a quasar is the nucleus of a galaxy. Namely, the galactic nucleus made up of galactoms and atoms absorbs the atomic cloud made up of atomic gases, to build its gravitational system. This initial atomic phase of galaxy formation is called the quasar. CFLE theory can explain the process of galactomic formation too. For example, before the initial atomic phase, there is an initial galactomic phase, about which is discussed in §13. One important point to emphasize about quasars is that those quasar phenomena cannot be explained by classical general relativity. Because a quasar is the initial phase of galaxy formation, and because a quasar does not have enough atomic material as a mass screening shielder, we should observe it as being small and heavy according to the results of CFLE theory. That is the qualitative answer of CFLE theory as a charge screening theory. From the next chapter onward, the quantitative answer about quasars as formulated by CFLE theory will be given.

11.13.2 Quantization of Quasar by CFLE theory

In §11.8, I discussed the quantized bar size. That is,

$R_{\otimes bulge} = 1.333 \times 10^{20}$ m

For galactic nucleus size, that correspond position of nucleus in proton and neutron (is called Black Hole), to quantize can be used charge interval constant $n = 1.190208 \times 10^{7}$

$$R_{\otimes quark} = \frac{1.333\times 10^{20}\ \mathrm{m}}{1.190208\times 10^{7}}$$

$$=1.120\times 10^{13}\mathrm{m} \qquad 11\text{-}13\text{-}2\text{-}1$$

Observed value as black hole is

$R_{\otimes BH} = 1.8\times 10^{13}$m

Difference of Two is

$$d_r = \frac{1.8\times 10^{13}\mathrm{m}}{1.120\times 10^{13}\mathrm{m}} = 1.61$$

This size$R_{\otimes nucleus} = 1.120\times 10^{13}$m is only for the radius of a photon sphere. The radius of the photon sphere, which is also the lower bound for any stable orbit, is

$$R_{Pho} = \frac{3GM}{c^2},$$

The difference is

$$d_R = \frac{R_{Pho}}{R_{sh}} = \frac{\frac{3GM}{c^2}}{\frac{2GM}{c^2}} = 1.5$$

Nett difference is

$$d_{nett} = \frac{1.61}{1.5} = 1.073$$

That is Earth's gravitational permittivity $x_{gEarth} = 1.073176$

Expected duration time by any reason is

$$t = \frac{2.240\times 10^{13} m}{2.998\times 10^{8} m}$$

$$= 7.497\times 10^{4}\ s$$

$$\approx 86400 s$$

$$= 1\ light\ day$$

Observed value is

$L_{Quasr} \leq c\tau_{var} \sim 1\ light\ day$

$= 2.5 \times 10^{13} m \sim 200 AU$ 11-13-2-2

Because force line curve of galactic muon is $g_{\otimes} = 3.836$ and with this minimum force strength of galactic chromo dynamics galactic quark can interact strongly,

Therefore, theoretical expected muonic quasar size is

$R_{\otimes muon} = \frac{1.120 \times 10^{13}\ \mathrm{m}}{(3.836)^2}$

$= 7.611 \times 10^{11}\mathrm{m}$ 11-13-2-3

The observed value of quasar size is around Jupiter's orbital radius on Earth observer. That is

R_{jupiter} = 5.2Au

= (5.20) (1.496×10^{11} m)

= 7.779×10^{11} m

≈ 7.611×10^{11} m 11-13-2-4

Because maximum mass number of galaxy is $A = 2027$ is, maximum quasar size is

$R_{\otimes max} = (7.611 \times 10^{11}\mathrm{m})(2027)$

$= 1.543 \times 10^{15} m$ 11-13-2-5

This results means that the theoretical value agrees well with the observed value. So this agreement gives assurance that CFLE theory is qualitatively correct for quasar theory too. This quasar is called the atomic quasar.

Observed quasar size is bigger than 10 ~ 10000 of radius of electromagnetic event horizon $R_{event} = 1.299 \times 10^{10} m$.

$R_{\otimes q} = 1.299 \times 10^{11} m \sim 1.299 \times 10^{14} m$ 11-13-2-6

How do we distinguish the initial phase of a galactomic quasar; namely, that this subatomic quasar is the pre-phase of a sub atomic galaxy? According to galactic orbital function, the quasar absorbed the atomic cloud made by atomic H and He gases, which is identifiable by the quasar's spectrum. Therefore, when the primordial galactic sub nucleus had absorbed atomic gases to build the galaxy, these gases and the primordial galactic sub nucleus interacted and emitted a specific electromagnetic wave giving rise to a specific quasar spectrum. The observed distant distribution range of the quasar to date is

$$Z = (6.43\sim6.28)-(5.82\sim5.50)-(4.89\sim4.01)-(3.50\sim3.48)-(2.88\sim2.02)-(0.37\sim0.16) \qquad 11\text{-}13\text{-}2\text{-}7$$

Such varied distribution of values only means that the galaxy was formed not only in the initial phase of cosmic history but also within an intermediate and present period too. If this prediction were right, then the galactic decay (discussed in §11.12) into a supernova explosion had to have occurred at every period of cosmic history. Therefore, high-energy wave observation techniques such as the Chandra x-ray satellite are needed to observe and discover such galactic remnants.

11.13.3 Quantization of Quasar Energy and Solving physical Meaning of Quasar Pulsation by CFLE theory

As discussed in §11.4, the quantized galaxy mass is

$$M_{\otimes} = M_{\odot}(1.190208 \times 10^{7})^{2}$$

$$= M_{\odot}(1.416595 \times 10^{14}) \qquad 11\text{-}13\text{-}3\text{-}1$$

This mass can be change to the solar mass $M_{\odot}$

$$M_{\otimes} = \frac{M_{\odot}(1.416595 \times 10^{14})}{2}$$

$$= 7.082975 \times 10^{13}\, M_{\odot} \qquad 11\text{-}13\text{-}3\text{-}2$$

But, because the force line curve of the present universe is $g^2 = (6.546)^2$, the expected pure mass of a quasar is

$$M_{\otimes} = \frac{7.083 \times 10^{13}\, M_{\odot}}{(6.546)^{2}}$$

$= 1.653 \times 10^{12}\ M_{\odot}$

$\approx 2 \times 10^{12}\ M_{\odot}$ 11-13-3-3

The observed value of the quasar energy is

$E_{\mathrm{g}} \approx 2 \times 10^{12}\ M_{\odot}$ 11-13-3-4

This agreement between predicted and experimental values shows that CFLE theory is a successful theory for quantitatively explaining quasar phenomena as well.

Finally, this result means that for a quasar to be considered as a galactic nucleus, a galactic strong force is needed. Therefore, according to the postulate of CFLE theory, the total strength of this strong nucleus energy is

$\alpha_{\mathrm{sg}} = \frac{g^2 e^2}{4\pi\varepsilon_0 \hbar c} = 1, \quad g^2 = 137.04 \approx 100$ 11-13-3-5

So, a quasar's energy is only 100 times stronger than that of a typical galaxy.

Reason of such atomic quasar activity correspond activity of the Sun and galactic mass ejection as relativistic jet correspond solar coronal mass ejection and jet of neutron star.

Because in the galactic nucleus material dense as neutron in neutron star and this material is experienced inertia with force line same as the Sun(fine explain:cf.§15)

11.14 Quantization of the Galactomic Quasar Size and Solving Origin of ultralong Gamma-Ray Burster by CFLE Theory

At the primordial phase of the Big-Bang, the galactomic gas contracted and built the galactomic quasar in the same way that interstellar atomic material and atomic gases formed stars. These two processes are qualitatively the same according to the correspondence property of all force lines and their elements. However, galactomic quasar absorbs atomic cloud and build atomic quasar from kaonic quasar, muonic quasar and atomic quasar. Size of muonic quasar is

$R_{\otimes m}$= 7.611× 10^{11} m 11-14-1

where $R_{\otimes m}$ is the size of the muonic quasar (cf. §11.13.2)

The expected quantized unit size of a galactomic quasar obtained is

$$R_{\otimes gq} = \frac{7.611 \times 10^{11}\ \mathrm{m}}{1.190208 \times 10^{7}}$$

$$= 6.396 \times 10^{4}\ \mathrm{m} \qquad 11\text{-}14\text{-}2$$

The related primordial galactic nucleus size from bulge size is

$$R = \frac{1.333 \times 10^{20}\ \mathrm{m}}{1.417 \times 10^{14}}$$

$$= 9.407 \times 10^{5}\ \mathrm{m} \qquad 11\text{-}14\text{-}3$$

Because needed force line curve for first nuclear reaction of galactomic muon is

$$g_{\otimes} = 3.836$$

Therefore, the effective radius is

$$R = \frac{9.407 \times 10^{5}\ \mathrm{m}}{(3.836)^{2}}$$

$$= 6.393 \times 10^{4}\ \mathrm{m} \qquad 11\text{-}14\text{-}4$$

When, in building the galactomic galaxy, the galactimic quasar absorbs galactomic gas from the intergalactic galactomic cloud, a related shock wave occurs. The expected duration of such shock wave by absorption is

$$\tau_{min} = \frac{(6.393 \times 10^{4}\ \mathrm{m})\,(2)}{2.998 \times 10^{8}\ \mathrm{m/s}}$$

$$= 4.265 \times 10^{-3}\ \mathrm{s}$$

$$\approx 4\ milliseconds\ !!! \qquad 11\text{-}14\text{-}5$$

Because the maximum mass number of the galaxy is

$A_{\otimes}$= 2027 11-14-6

We therefore expect the maximum size of a galactomic quasar to be

$R_{\otimes q}$ = (6.396 × 10^4 m) (2027)

= 1.296 × 10^8 m 11-14-7

The expected duration of the maximum galactomic quasar is

$$\tau = \frac{(1.296\times 10^8\ \mathrm{m})\ (2)}{2.998 \times 10^8\ \mathrm{m/s}}$$

=0.865 s !!!

≈1 s 11-14-8

The main duration time of a galactomic quasar

$\tau \approx$ 1 s 11-14-9

But, because the galaxy mass number is $A = 2$, expected maximum duration by any reason is

$\tau =$ 1 s$\times$ 2

=2s!!! 11-14-10

Such duration time of galactomic quasar overlap with duration of gamma ray burst from supernovae. Surprisingly astronomer use two seconds for long and short burst to distinguish, and because atomic quasar radiate strong energy like variable star.

Therefore part of short gamma ray burst should be radiated from galctomic quasar with same energy scale of short gamma burster. It is really not easy to deny for such possibility.

Furthermore, inside of event horizon means that there is quark's region and enough energy is stored for gamma ray to radiate. Therefore galactic core that smaller than electromagnetic event horizon can be long gamma ray buster. Because unit galaxy radius of electromagnetic event horizon of sgrA* is $R_{\otimes event} = 1.299 \times 10^{10} m = 41\ light - second$, maximum duration time can be

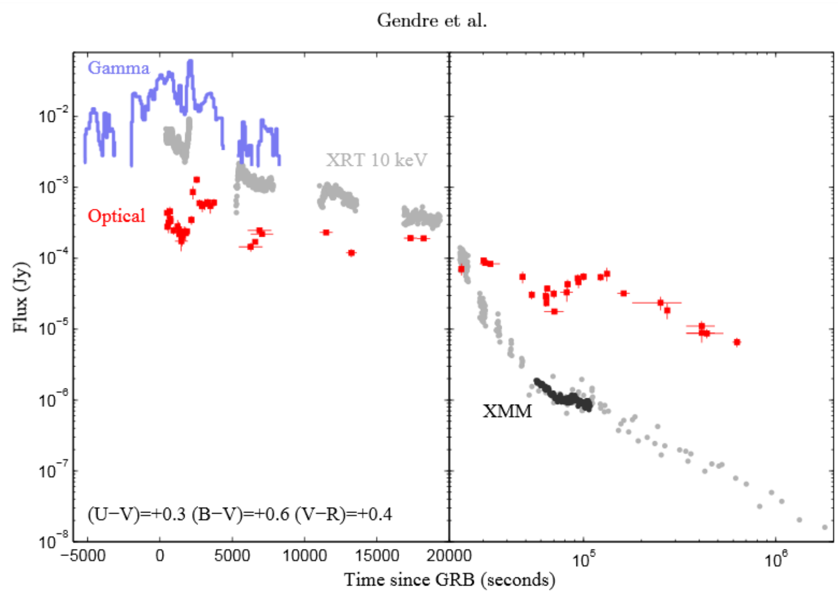
$\tau_{max} = (2)(41)(2027)$

$= 166214s$

$= 46hours$

$\approx 2\ days$ 11-14-11

GRB 111209A is the longest lasting gamma-ray burst detected by the Swift Gamma–Ray Burst Mission on Dec 9, 2011(at $T_o = 2011:12:09 - 07:12:08\ UT, Hoversten\ et\ al\ 2011)$.Its duration is longer than 7 hours only with $z = 0.677$ an isotropic energy $E_{iso} = 5.82 \times 10^{53} erg$, implying this event has a different kind of progenitor than normal long GRBs.



The light curve of GRB 111209A, presented with a temporal axis which is linear in the left panel (the prompt emission) and logarithmic in the right panel (after glow emission). X-ray data are grey (XRT) and black (XMM –Newton)

Figure 11-14-1

It should be proposed that the progenitor of this event must be big size galactic core, because according to CFLE theory any star can have such big size with such big energy.

Radius of the unit star if this star could radiate gamma-ray, would be

$R_N = 1 \times 10^8 m$

Because maximum mass number of the star is$A = 347$, maximum star size for gamma ray radiation should be only

$$R_{Nmax} = (1 \times 10^8 m)(347) = 3.47 \times 10^{10} m \qquad 11\text{-}14\text{-}12$$

Duration time is only

$$\tau_d = \frac{(2)(3.47 \times 10^{10} m)}{(3 \times 10^8 ms^{-1})} = 2.3 \times 10^2 s \qquad 11\text{-}14\text{-}13$$

Therefore it is concluded that progenitor of ultra long gamma -ray burst should be galactic core. The last phase of primordial galactomic nuclei synthesis reached to the boundary of the atomic quasar. Because the size of a quantized atomic quasar is

$$R_{\otimes aq} = 7.611 \times 10^{11} \text{ m} \qquad 11\text{-}13\text{-}2\text{-}3$$

the expected duration of this maximum atomic quasar by any reason is

$$\tau = \frac{(7.611 \times 10^{11} \text{ m})\ (2)}{2.998 \times 10^8 \text{ m/s}}$$

$$= 5.077 \times 10^3 \text{ s}$$

$$= 84.62 \text{ min}$$

$$\approx 1.4\ hours \qquad 11\text{-}14\text{-}14$$

But, because the force line curve of the start energy state is $g_s = \frac{3.836}{1.5}$, expected maximum duration is

$$\tau_{max} = (84.62\text{min})\ (2.557)$$

$$=216.4 \text{ min}$$

$$=12{,}982\text{s}$$

$$\approx 3.6\ hours \qquad 11\text{-}14\text{-}15$$

Observed value is

$$\tau_{max} \approx 10{,}000 \text{ s}$$

Regular duration time of quasar correspond atomic nuclear force strength $g_{\otimes qua} = \frac{3.836}{1.5} = 2.557$ is

$$\tau_{\otimes} = \frac{84.62\ \text{min}}{(2.557)(1.025161)}$$

$$= 33.09\ \text{min}$$

$$\approx 33\ \text{min} \qquad 11\text{-}14\text{-}16$$

Ordinary matter density by WMAP is $\rho_{ord} = 0.046\%$. This means that 0.046 is force line curve $g^2 = 21.74 = (4.663)^2$.

Because gravitational permittivity of air at Earth's surface is $x_e = 1.033548$, observed force line curve is

$$g_{ob} = 4.663 \times 1.033548 = 4.819$$

Expected radius maximum galactic nucleus is

$$R_{\otimes N} = (7.611 \times 10^{11} m)(4.819)^2$$

$$= 1.767 \times 10^{13} m \qquad 11\text{-}14\text{-}17$$

This radius is called stellar horizon, because outside from this radius can be stars orbited.

Observed value by astronomers as radius of super massive black hole is

$$R_{\otimes BH} = 1.8 \times 10^{13} m \qquad 11\text{-}14\text{-}18$$

Expected duration time by any physical reason is

$$\tau_d = \frac{(2)(1.767 \times 10^{13} m)}{(2.998 \times 10^8 ms^{-1})}$$

$$= 1.179 \times 10^5 s$$

$$\approx 33 hours \qquad 11\text{-}14\text{-}19$$

Therefore progenitor of ultra long gamma ray burst of GRB 111209A should be active galactic nuclei (AGN) by galactic activity correspond solar activity by inertia of force line with energy of inertial moment.

11.15 Obtaining the Age of the Cosmos from the Solar Age by CFLE Theory

Researchers Meenakshi Wadhwa and Audrey Bouvier, both affiliated with Arizona State University, had studied a piece of the meteorite NWA 2364 that fell to Earth in Morocco in 2004, and discovered that the space rock was $T = 4.5682 \times 10^9$ years old. Predating the previous estimate of the solar system age by up to 1.9 million years, this adjustment, though ever so slight, should help astronomers better understand the age of the cosmos. The part of NWA 2364 examined was the A1-center chunk known as a calcium-aluminum-rich inclusion or CAI. Inclusions are minerals that get trapped inside meteorites as the space rocks are forming. It is believed CAIs were among the first solids to condense out when the sun and planets were forming, so CAI ages are good representations of the solar system's age.

Wadhwa and Bouvier used lead–lead dating, a technique commonly used to date meteorites, to estimate the CAI's age. They measured the abundance of the three isotopes of the element lead using different atomic masses in the CAI. Two of the lead isotopes form when uranium isotopes under radioactive decay, whereas the third one is not a decay product. Comparing the amounts of the three lead isotopes and relating those numbers to the known rate of uranium isotope decay gave the answer

$$T = 4.5682 \times 10^9 \text{ years} \qquad \text{11-15-1}$$

According to a minimum force line curve of $g = 2$, and correspondence number $c_c = 1.5$, the possible minimum age of such universe is

$$T = (4.5682 \times 10^9 \text{ years})\ (2)\ (1.5)$$

$$= 1.37046 \times 10^{10} \text{ years} \qquad \text{11-15-2}$$

Because the electrical permittivity of a particle of $g\ c_c = (8)\ (1.5) = 3$ is

$$Q_e = (0.000589)\ (12) = 0.007068$$

$$x_e = 1.007068$$

$$T = (1.37046 \times 10^{10} \text{ years})\ (1.007068)$$

$$= 1.380146 \times 10^{10} \text{ years} \qquad \text{11-15-3}$$

This age is the maximum age of stars in the galaxy, because stellar syntheses started at $g = 2$. This value agrees well with the experimental value of NASA's WMAP and PLANCK's

T_W= 13.772 billion years

T_W= 13.813 billion years 11-15-4

This value is called the age of the atomic world.

However, CFLE theory introduces one more force line (galactic force line), so we can obtain the age of the galaxy worlds by using the force quantization constant

$N = 1.190208 \times 10^7$

Therefore, the minimum age of the galaxy is

$T = (1.380 \times 10^{10})\ (1.190 \times 10^7)$

$= 1.642 \times 10^{17}$ years 11-15-5

Because the maximum mass number of the galaxy is A = 2027, the maximum age of the galaxy is

$T = (1.642 \times 10^{17})\ (2027)$

$= 3.328 \times 10^{20}$ years 11-15-6

Because correspondence number $(C_c)^2 = (1.5)^2 = 2.25$ and related gravitational permittivity $x_i = 1.016774$ and electrical permittivity at $g = 4.663$ is

x_e = 1+(0.000589× 4.663)=1.002747

$\frac{1.016774}{1.002747} = 1.013989$

The total additional effect is

$E_{\text{add}} = \frac{2.25}{1.013989}$

$= 2.219$

Therefore, the real value of this age is

$T = (3.328\times 10^{20}$ years) (2.219)

$= 7.386 \times 10^{20}$ years 11-15-7

This age is called the age of the galactic universe.

11.16 Macro Energy Quantum $\hbar_{\mathbf{A}}$ of the Atomic World and Its Meaning: Quantization of Galactic Center as sgr A*

In §11.9.1, the galactic macro energy quantum $h_{\otimes}$ was determined to be

$h_{\otimes} = 5.704645 \times 10^{70}$ Js

But, because the force quantum constant is $N = 1.190208 \times 10^{7}$, the macro energy quantum for the galactic world is

$h_{\otimes\mathrm{g}} = (5.704645 \times 10^{70}$ Js) (1.190208×10^{7})

$= 6.789714 \times 10^{77}$ Js 11-16-1

Therefore, the galactic world energy quantum is

$$\hbar_{\otimes g} = \frac{h_{\otimes\mathrm{g}}}{2\pi}$$

$= 1.080616 \times 10^{77}$ Js 11-16-2

This energy quantum includes useful information. Because the observed expansions speed of the galaxy (cf.§13-15-4-1) is

$V = 7.134 \times 10^{4}$ m/s

and the galaxy mass is

$M_{\otimes} = 1.409 \times 10^{44}$ kg

the quantized size of the galactic world is

$$R_{\Delta\otimes g} = \frac{\hbar_{\otimes g}}{\Delta m_{\otimes} v_{\otimes}}$$

$$= \frac{1.081 \times 10^{77}\ \mathrm{Js}}{(1.409 \times 10^{44}\ \mathrm{kg})(7.134 \times 10^{4}\ \mathrm{m/s})}$$

$= 1.075 \times 10^{28}$ m 11-16-3

The horizon factor is

$HO = g^2\, c_c^{\,2} = (6.546)^2\, (1.5)^2$

$= 96.41$ 11-16-4

Because the keplerian missing factor f_{kepler} =1.162 from 11- 5-9is, horizon factor is

$HO' = \frac{96.412}{1.162}$

$= 82.97$ 11-16-5

So according to CFLE theory, an observer around the Earth system (satellite) would measure this size as

$R_{\otimes} = \frac{1.075\times 10^{28}\ \text{m}}{82.97}$

$= 1.295 \times 10^{26}$ m 11-16-6

The observed value is

$R_{\otimes} = 1.295 \times 10^{26}$ m

Because this value agrees well with the observations value, we obtain again assurance about CFLE theory.

CFLE theory can quantize size of galactic center, because center of Milky Way as sgr A*is not black hole. Black hole size cannot be quantized by any method, because Einstein's general relativity don't permit any quantization.

Ordinary matter density by WMAP is $\rho_{ord} = 0.046\%$. This means that 0.046 is force line curve $g^2 = 21.74 = (4.663)^2$.

Because gravitational permittivity of air at Earth's surface is $x_e = 1.033548$, observed force line curve is

$g_{ob} = 4.663 \times 1.033548 = 4.819$

expected radius maximum galactic nucleus is

$R_{\otimes N} = (7.611 \times 10^{11} m)(4.819)^2$

$=1.767\times 10^{13} m$ 11-16-7

This radius is called stellar horizon, because outside from this radius can be stars orbited.

Observed value by astronomers as radius of center of Milky Way is

$R_{\otimes BH} = 1.8 \times 10^{13} m$ 11-16-8

CFLE theory can quantize mass of galactic center as sgr A* by charge interval constant $N_s = 1.190208 \times 10^7$

Because total mass of our milky way is $M_{\otimes milky} = 1.409 \times 10^{44} kg$

Expected mass of galactic nucleus mass for observer of Earth's surface is

$M_{\otimes N} = \frac{(1.409\times 10^{44} kg)(1.033548)(1.000589)}{(1.5)(1.190\times 10^7)} = 8.162 \times 10^{36} kg$ 11-16-9

Observed value as center of Milky Way is

$M_{BH}=8.2\times 10^{36} kg$ 11-16-10

Electromagnetic horizon of galactic nucleus

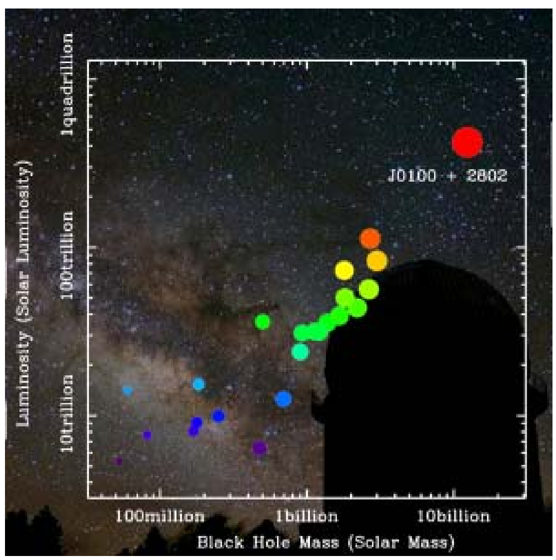
$R_{SE} = (41)(2.998\times 10^8 m) = 1.229 \times 10^{10} m$ 11-16-11

11.17 Solving Mystery of Distant Quasar Mass Growth in the History of the early Universe by the Galactic Seed

Present observations reveal that quasars were much more frequent when the Universe was younger, indicating that super massive black holes formed and grew early. A major constraining factor for theories of super massive black hole formation is the observation of distant luminous quasars, which indicate that super massive black holes of billions of solar masses had already formed when the Universe was less than one billion years old. This suggests that super massive black holes arose very early in the Universe, inside the first massive galaxies.

So far, roughly 40 quasars with red shift greater than $z = 6$ have been discovered. Each quasar contains a black hole with a mass of about one billion solar masses $10^9 M_\odot$. The existence of such black holes when the Universe was less than one billion years old presents substantial challenges to theories of the formation and growth of black holes and the coevolution of black holes and galaxies. Current theory is for a limit to how fast a black hole can grow, but this black hole is too large for that theory.

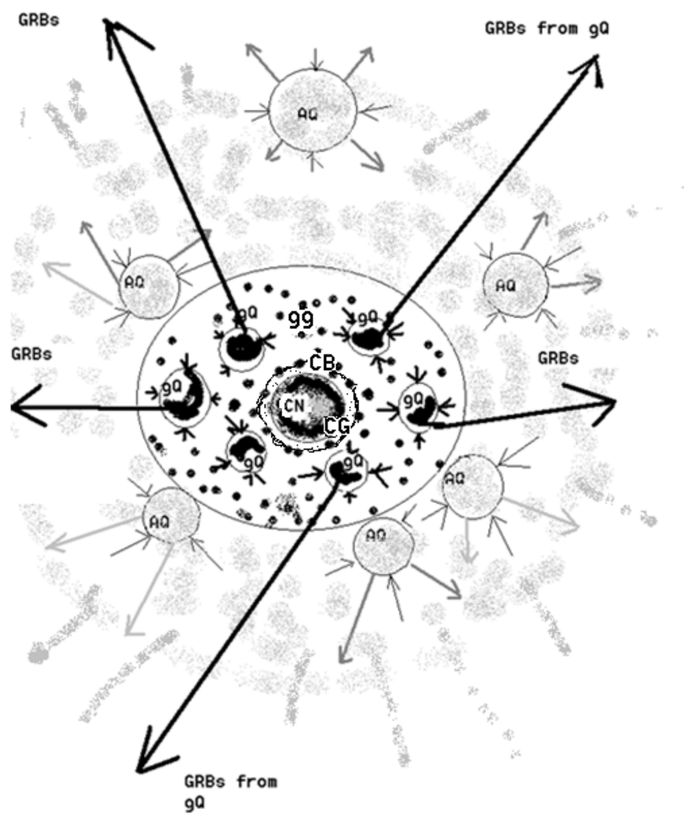
Such serious contradiction becomes what is the origin of the M-sigma relation between super massive black hole mass and galaxy velocity dispersion and how did the most distant quasars grow their super massive black holes up to 10^9 solar masses so early at $z = 6.30$!!! in the history of the Universe(e.g. Quasar SDSS J0100.02+280225.8 that has $1.2\times 10^{10} M_\odot$.This huge mass swallows up their black hole theory) They, general relativists, on the pretext of black hole that anybody cannot know exactly, try to extend of life of incapable dead theory with their proper valuable mathematical skill.



The newly discovered quasar SDSS J010013.02+280225.8 is the one with the most massive black hole and the highest luminosity among all known distant quasars by Zhaoyu Li/Shanghai Astronomical Observatory; background image from Yunnan Observatories: 'Current theory is for a limit to how fast a black hole can grow, but this black hole is too large for that theory.'- *Fuyan Bian, Australian National University* .Reuters Posted: Feb 25, 2015 1:55 PM ET Last Updated: Feb 25, 2015 4:07 PM ET

Figure11-17-1

However, CFLE theory can answer correctly by galactomic Seed.
From §11 to §13.16, I have briefly discussed phenomena relating to galaxy formation by galactomic Seed. This information about the galaxy formation by galactomic Seed process is summarized in Figure 13-7-1.



In the figure, AQ is the atomic quasar, AG is the atomic primordial galaxy, gQ is the galactomic quasar, CN is the cosmotomic nucleus, CB is the bulge of the cosmotomic nucleus, CG is cosmotomic gas, and gg is the galactomic gas.

Figure 11-17-2

When Big-Bang start, galactomic Seed start absorption of mass. In side of this circle of figure 11-17-1 is nucleus of positive universe. At that time quasar is called galactomic quasar, because galactomic Seed absorb only galactomic gas. Outside of this boundary quasar is called atomic quasar, because galctomic nucleus can absorb atomic gas as resent galactic nucleus.

This galaxy formation process at early universe is very important, because black hole don't need any more for galaxy evolution.

Mass increase of galactic nucleus is absorption of mass by only galactic seed. Energy of this process is needed$10^{65}\sim 10^{68}erg$. Therefore, it can be predicted that during this process galactic nuclei should be radiated strong beam with energy$10^{58}\sim 10^{61}J$. For comparison Energy scale of gamma ray burst is$10^{44}\sim 10^{47}J$. With this galaxy formation by galactic Seed we can answer how did the most distant quasars grow their mass up to 10^9 solar masses so early in the history of the Universe.

11.18 Galactic Charge Quantization by CFLE Theory

11.18.1Solving Origin of M-*σ* Relation by CFLE Theory

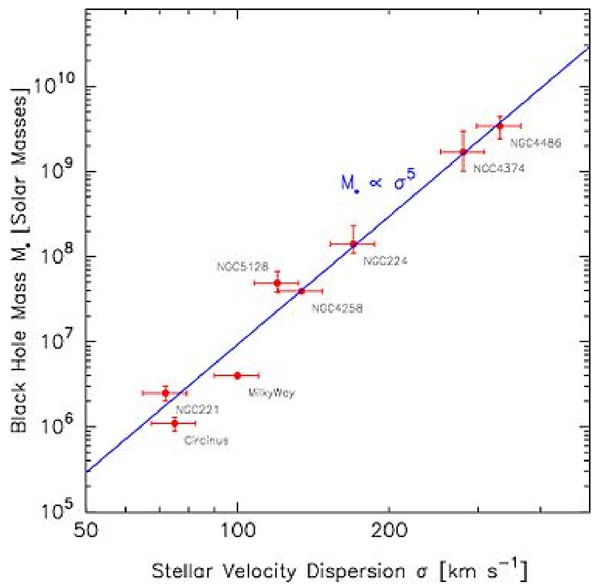
The M–sigma (or *M*–*σ*) relation is an empirical correlation between the stellar velocity dispersion σ of a galaxy bulge and the mass M of its center.

The M–σ relation was first presented in 1999 during a conference at the Institut d'astrophysique de Paris in France. The proposed form of the relation, which was called the "Faber–Jackson law was

$$\frac{M}{10^8 M_\odot} \approx 3.1\left(\frac{\sigma}{200kms^{-1}}\right)^4 \qquad \text{11-18-1-1}$$

where $M_\odot$ is the solar mass. Publication of the relation in a refereed journal, by two groups, took place the following year. One recent study, based on a complete sample of published black hole masses in nearby galaxies, gives

$$\frac{M}{10^8 M_\odot} \approx 1.9\left(\frac{\sigma}{200kms^{-1}}\right)^{5.1} \qquad \text{11-18-1-2}$$



mass of galactic center plotted against velocity dispersion of stars in a galaxy bulge. Points are labelled by galaxy name; all points in this diagram are for galaxies that have a clear, Keplerian rise in velocity near the center, indicative of the presence of a central mass. The *M–σ* relation is shown in solid line.

Figure 11- 18-1-1

A common use of the *M–σ* relation is to estimate black hole masses in distant galaxies using the easily measured quantity σ. Black hole masses in thousands of galaxies have been estimated in this way. The M–σ relation is also used to calibrate so-called secondary and tertiary mass estimators, which relate the black hole mass to the strength of emission lines from hot gas in the nucleus or to the velocity dispersion of gas in the bulge. The tightness of the M–σ relation suggests that some kind of feedback acts to maintain the connection between mass of galactic center and stellar velocity dispersion, in spite of processes like galaxy mergers and gas accretion that might be expected to increase the scatter over time. The much smaller scatter of the *M–σ* relation is generally interpreted to imply some source of mechanical feedback between the growth of mass of galactic center and the growth of galaxy bulges, although the source of this feedback is still uncertain.

However, CFLE theory can answer by charge interval constant $S_n = 1.190208 \times 10^7$ what is the origin of the M-sigma relation between mass of galactic center and galaxy velocity dispersion.

Because stellar mass is bind by strong force, force strength difference between galactic center and orbited stellar is $d_f = 1.190208\ \times 10^7$.

Therefore, formula Eq.11-18-1-2 can we rewrite

$$\frac{M}{10^8 M_\odot} \approx 1.9(\frac{\sigma}{200kms^{-1}})^{5.1} \rightarrow \frac{M}{10^8 M_\odot} \approx (1.9)(1.259 \times 10^5)(\frac{\sigma}{200kms^{-1}})$$

This rewrite formula must be satisfied charge interval constant, because left side is maximum stellar charge term and right term is correspond maximum galactic charge term

$$(1.9)(1.259 \times 10^5)(\frac{\sigma}{200kms^{-1}}) = 1.190208 \times 10^7 \qquad 11\text{-}18\text{-}1\text{-}3$$

First term is called correspondence number term. Pure value is

$$c_c^2 = (1.5)^2 = 2.250 \qquad 11\text{-}18\text{-}1\text{-}4$$

Third term is called maximum force line curve term or dark matter term. Pure value is

$$g_c^2 = (6.545979)^2 = 42.849841 \qquad 11\text{-}18\text{-}1\text{-}5$$

This means that

$$(\frac{\sigma}{200kms^{-1}}) \leq 42.849841 \qquad 11\text{-}18\text{-}1\text{-}6$$

Second term is called sigma term, should be

$$n_\sigma = \frac{1.190208 \times 10^7}{(2.250)(42.849841)} = 123450 \qquad 11\text{-}18\text{-}1\text{-}7$$

Now, we can write original formula with exact quantity

$$\frac{M}{10^8 M_\odot} \approx 2.25(\frac{\sigma}{200kms^{-1}})^{5.09149} \qquad 11\text{-}18\text{-}1\text{-}8$$

First term and Third term is none other than Horizon Factor

$$HO = g_c^2 \cdot c_c^2 = 96.412142 \qquad 11\text{-}18\text{-}1\text{-}9$$

This quantized result shows that galactic center is not black hole, because according to Penrose-Hawking Theorem black hole must have singularity of infinite.

11.18.2 Obtaining Galaxon Speed by CFLE Theory

In §7.6.3 speed of free gluon as gluomagnetic boson by strong charge or stellar charge according to formula $R_s = \frac{2GM}{c^2} \rightarrow c = \sqrt{\frac{2GM}{R_s}}$ is

$$c_{light} \cdot N_{\odot} = \sqrt{\frac{2GM(137.035997)}{(R_{shwartz\,schild})/(137.035997)}} \quad \text{7-6-3-5}$$

$$c_{free\ gluon} = 4.10823584 \times 10^{10} ms^{-1} \quad \text{7-6-3-5}$$

However, galactic charge is 1.190208× 10^7 time stronger than quark's charge or stellar charge.

Therefore, expected speed of galaxon as glactromagnetic boson that build by galactic force line is

$$c_{gluon} \cdot N_{\otimes} = \sqrt{\frac{(2GM)(1.190208\times10^7)}{(R_{shwartz\,schild})/(1.190208\times10^7)}} \quad \text{11-18-2-1}$$

$$c_{galaxon} = c_{gluon} \cdot 1.190208 \times 10^7$$

$$= (4.10823584\times 10^{10} ms^{-1})(1.190208 \times 10^7) \quad \text{11-18-2-2}$$

$$c_{galaxon} = 4.889655 \times 10^{17} ms^{-1} \quad \text{11-18-2-3}$$

where G is used G_{newton} =6.673838× 10^{-11}N. (m/kg)^2

Size of galactromagnetic event horizon of sgrA* according to formula $R_s = \frac{2GM}{c^2}$ is

$$R_{\otimes} = \frac{(2)(6.673838\times10^{-11}C)(8.2\times10^{36}kg)}{(4.889655\times10^{17})^2}$$

$$= 4.578 \times 10^{-9} m \quad \text{11-18-2-4}$$

electromagnetic event horizon of sgrA^* as galactic nucleus is

$$R_{\otimes} = 1.299 \times 10^{10} m$$

Galaxy's Galactromagnetic charge is 10^7 stronger than stellomagnetic charge or gluomagnetic charge. But gravitational mass charge of galaxy is qualitatively same as stellar gravitational mass as electron that's electric charge correspond gravitationally 10^{-8} kg, but gravitational mass is only$10^{-30}kg$. We cannot observe such strong mass of electron by electromagnetic interaction between electromagnetic charges.

However,nobody think not strange about such charge's nature of electron.

For the first time scientists face same charge's nature of galactic charge. Because scientists are involved infinite black hole curse by mathematical incantation of general relativity, they cannot recognize simple essence of charge's nature of galaxy and cosmos.

11.19 Structure of Galactic Nucleus by CFLE Theory

Because now black hole that is heavy barrier for phenomena from galactic nucleus to explain is excluded, we can construct structure of galactic nucleus.

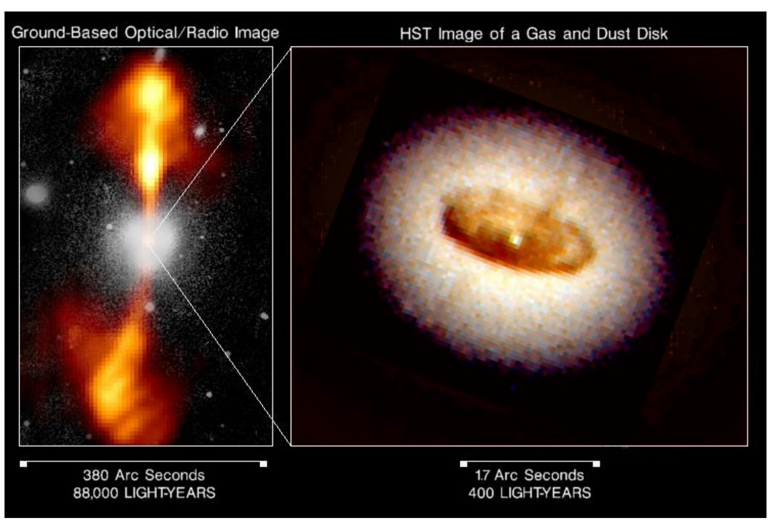


Photo 11-19-1 NGC 4261

Photo 11-19-1 shows NGC 4261 and related limit of modern physics.

In right photo white point is mass center of galaxy 4261. However, inside of this point is called only super massive black hole. That's all.

All other quantum phenomena from galactic center are buried under name of black hole. However, black hole cannot give us responsible answer and explanation. Scientists of old age know very well about this point and they enjoy this point for responsibility to avoid. Therefore, black hole becomes holy last escape place where inability of old theory of general relativity can be hide very well without right resistance from experimental evidences and new theory.

11.19.1 Structure of galactic nucleus

However, CFLE theory can explain structure of nucleus of galaxy as Figure 11-19-1.

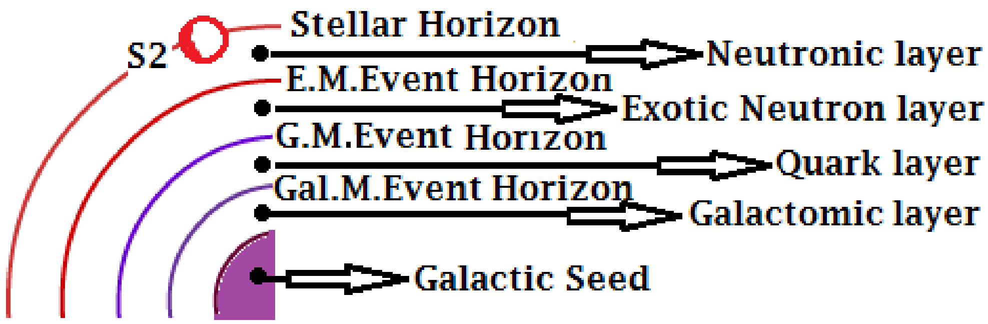


Figure 11-19-1-1

Components of each layer are:

●Quasar horizon

While the nature of these objects was controversial until the early 1980s, there is now a scientific consensus that a quasar is a compact region in the center of a massive galaxy surrounding a central super massive black hole. Its size is 10–10,000 times the Schwarzschild radius of the black hole. Quasars' luminosities are variable, with time scales that range from months to hours. This means that quasars generate and emit their energy from a very small region, since each part of the quasar would have to be in contact with other parts on such a time scale to allow the coordination of the luminosity variations. This would mean that a quasar varying on a time scale of a few weeks cannot be larger than a few light-weeks across. The emission of large amounts of power from a small region requires a power source far more efficient than the nuclear fusion that powers stars.

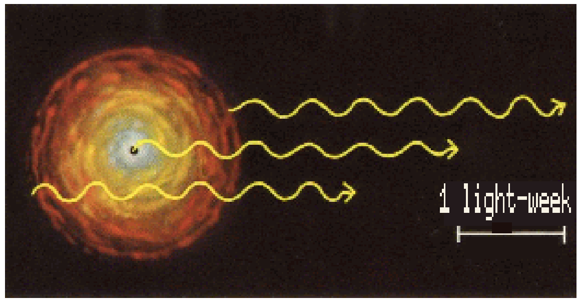


Figure 11-19-1-2

1 lwk=1.813× $10^{14} m$

From Eq 11.13.2.5 quasar size is

$R_{\otimes max} = 1.543\times 10^{15} m$ 11-13-2-5

Therefore quasar horizon is

$R_{quasar} = 1.543\times 10^{15} m \sim 1.813\times 10^{14} m$ 11-19-1-1

●Stellar horizon

Astronomers are confident that our own Milky Way galaxy has a super massive black hole at its center, 26,000 light-years from the Solar System, in a region called Sagittarius A* because:

- The star S2 follows an elliptical orbit with a period of 15.2 years and a pericenter (closest distance) of 17 light-hours (1.8×10^{13} m or 120 AU) from the center of the central object.
- From the motion of star S2, the object's mass can be estimated as 4.1 million $M_{\odot}$,[or about 8.2×10^{36} kg.
- The radius of the central object must be less than 17 light-hours, because otherwise, S2 would collide with it.

$R_{stellar} = 1.8 \times 10^{13} m$ 11-19-1-2

Neutron layer between $1.8 \times 10^{13}m \sim 1.299 \times 10^{10}m$ is correspond neutron star. In this layer neutrons are condensed as in neutron star. This layer emit correspondent X-ray as neutron star.

●Electromagnetic event horizon

In general relativity, an event horizon is a boundary in space-time beyond which events cannot affect an outside observer. In layman's terms, it is defined as "the point of no return", i.e., the point at which the gravitational pull becomes so great as to make escape impossible. An event horizon is most commonly associated with black holes. Light emitted from beyond the event horizon can never reach the outside observer.

The Schwarzschild radius (sometimes historically referred to as the gravitational radius) is the radius of a sphere such that, if all the mass of an object were to be compressed within that sphere, the escape velocity from the surface of the sphere would equal the speed of light. An object where the mass is within its Schwarzschild radius is a black hole.

The Schwarzschild radius is proportional to the mass with a proportionality constant involving the gravitational constant and the speed of light

$$r_s = \frac{2GM}{c^2}, \qquad \text{11-19-1-3}$$

where: r_s is the Schwarzschild radius; G is the gravitational constant;

M is the mass of the object; c is the speed of light in vacuum.

When mass m_{GC} =8.2×10^{36} kg is, this radius is

$$R_{event} = 1.299 \times 10^{10}m \qquad \text{11-19-1-4}$$

Exotic neutron layer between $1.299 \times 10^{10}m$ ~ $6.921 \times 10^{5}m$ correspond exotic neutron star. In this layer exotic neutrons are condensed as in exotic neutron star. This layer emit correspondent ultra luminous X-ray as ultra luminous x-ray source.

In August 1999, the Chandra X-ray Observatory observed its first celestial target, quasar PKS 0637- 752, during the initial focusing of the telescope [Schwartz et al. 2000, Chartas et al. 2000]. Along with the bright quasar core, Chandra unexpectedly detected X-rays from the kilo-parsec scale relativistic jet (previously known from radio imaging).

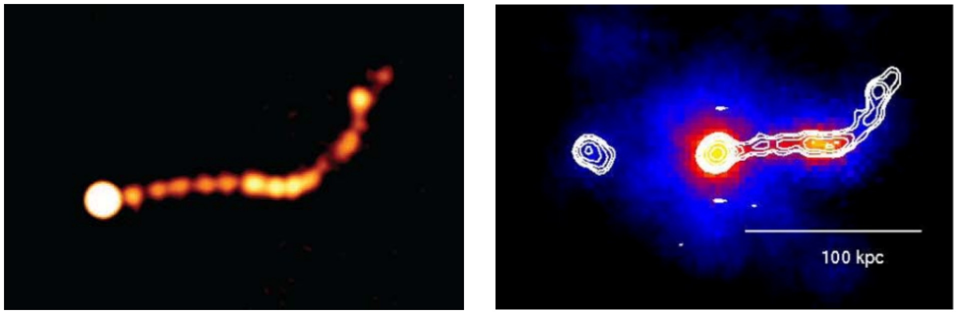


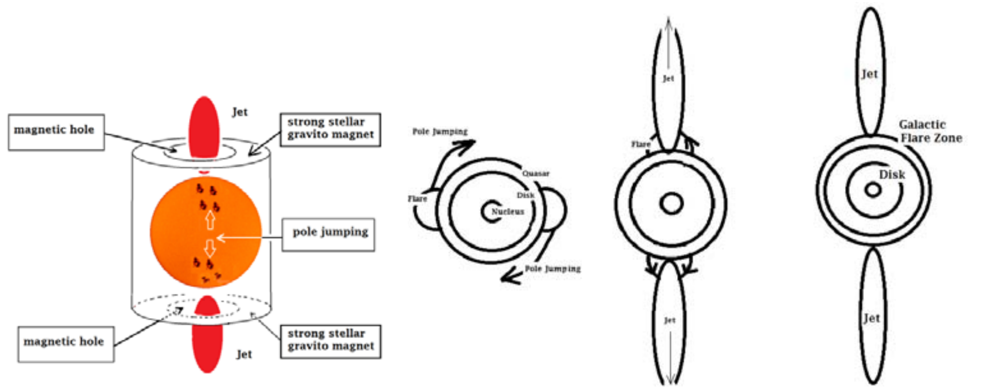
Figure 11-9-1-3

Unlike the synchrotron spectrum of lower power FR I jets like M87 which easily extend up to X-ray energies [e.g. Wilson and Yang 2002], the synchrotron spectrum of powerful quasar jets (including

PKS 0637-752) generally peak at or below the IR/Optical band. The X-rays detected in the kpc scale jet of PKS 0637-752 were orders of magnitude brighter than expected from the radio-optical synchrotron

Spectrum,or indeed from either synchrotron self-Compton (SSC) or inverse Compton up scattering of ambient CMB photons (IC/CMB) under equipartition conditions [Chartas et al. 2000]. Further, the X-ray spectrum of the jet was remarkably hard, with a photon index of 1.76 ± 0.1. The physical origin of the X-ray emission in powerful quasar jets has been a long-standing mystery. Though these jets start out on the sub-pc scale as highly relativistic flows, astronomer do not have any direct measurement of their speeds on the kpc scale, where the vast distances from the core necessitate in situ particle acceleration.

However, here we can try to explain this origin mystery of X-ray spectrum of jet. Galactic core can be origin of X-ray and γ-ray of kpc scale jet from AGN at pole by surrounded strong gravito magnet as surround pulsar magnet.



Jet from pulsar **Jet from quasar** **Jet from AGN**

Figure 11-9-1-4

● Gluomagnetic event horizon

Because speed of free gluon is

$$c_{free\ gluon} = 4.10823584\times 10^{10} ms^{-1} \qquad 11\text{-}19\text{-}1\text{-}5$$

Gluomagnetic event horizon is

$$R_{event} = \frac{1.299\times10^{10}m}{(137.035997)^2}$$

$$= 6.921\times 10^{5}m \qquad 11\text{-}19\text{-}1\text{-}6$$

Quarks layer after $6.219 \times 10^5 m$ correspond exotic quark star. In this layer quarks are condensed as in quark star. This layer emits gluon and observed gamma-ray as another gamma ray burster of long and ultra long duration of gamma ray burst.

Without this structure we cannot explain even how short-duration high-intensity bursts originate, because size of gamma ray burster is smaller than electromagnetic event horizon.

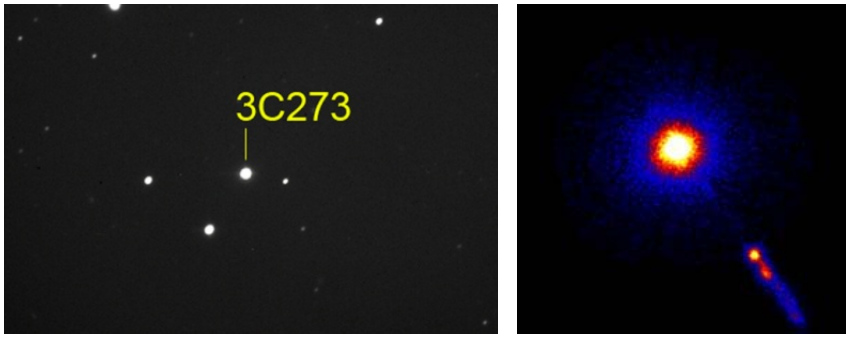


Figure 11-9-1-5 Jet from 3C273

●Galactro magnetic event horizon

Because speed of galaxon is

$$c_{galaxon} = 4.889655 \times 10^{17} ms^{-1} \qquad 11\text{-}19\text{-}1\text{-}7$$

Therefore galactro magnetic event horizon of sgrA* according to formula $R_s = \frac{2GM}{c^2}$ is

$$R_{\otimes} = \frac{(2)(6.673838 \times 10^{-11} C)(8.2 \times 10^{36} kg)}{(4.889655 \times 10^{17})^2}$$

$$= 4.578 \times 10^{-9} m \qquad 11\text{-}19\text{-}1\text{-}8$$

After Quark layer of $6.219 \times 10^5 m$ to galactromagnetic event horizon of $4.578 \times 10^{-9} m$ start galactomic layer, galactomic neutron layer, exotic galactomic neutron layer. These layers emit galactromagnetic wave according to galactic activity correspond sun's activity.

●Galactic seed

Inside of galactromagnetic event horizon $R_{\otimes} = 4.578 \times 10^{-9} m$ is called galactic Seed.

By this structure we can explain mystery of galaxy genesis.

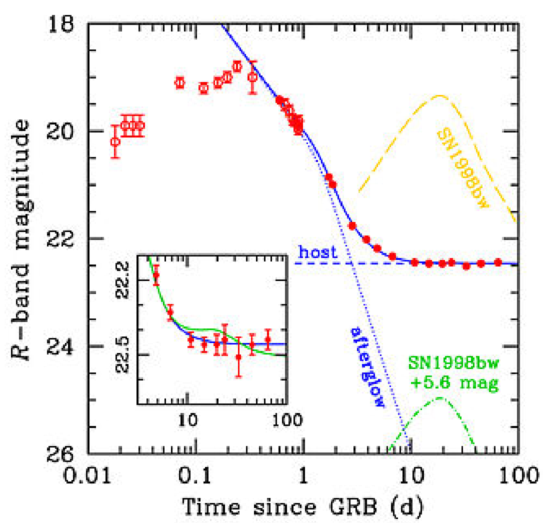
Firstly, gravitational fluctuation don't need in early universe for galaxy formation, because galactic Seed was there.

Secondly, because of material absorption by galactic Seed, we don't need worry about early material swallowing by black hole.

11.19.2. Solving Origin Mystery of ultra long Gamma-ray Burst from AGN

Long-duration bursts are associated with the deaths of massive stars in a specific kind of supernova-like event commonly referred to as a collapsar. However, there is also long-duration GRBs that show evidence against an associated supernova, such as the Swift event GRB 060614. GRB 060614 was a remarkable gamma-ray burst (GRB) detected by the Swift satellite on June 14, 2006 with puzzling properties, which challenge current progenitor models.

In particular, the lack of any bright supernova (SN) down to very strict limits and the vanishing spectral lags during the whole burst are typical of short GRBs, strikingly at odds with the long (102s) duration of this event and its origin in a galaxy 1.6 billion light years away in the constellation Indus. The burst lasted for 102 seconds, placing it soundly in long-burst territory. But the burst lacked the hallmark of a supernova, or star explosion, commonly seen shortly after long bursts.



Light curve of GRB 060614

Figure 11-19-2-1

Therefore, another gamma ray burster is needed. That is none other than AGN according to CFLE theory. In Galactic Activity explodes dense neutron and quark that was absorbed by galactic seed. This is cause of gamma-ray burst by AGN. These events are at the tail end of the long GRB duration distribution, lasting more than 10,000 seconds.

More than 10,000 seconds means $< 10^{13}m$

Such big size object with huge energetic gamma ray burst can be only galactic nucleus.

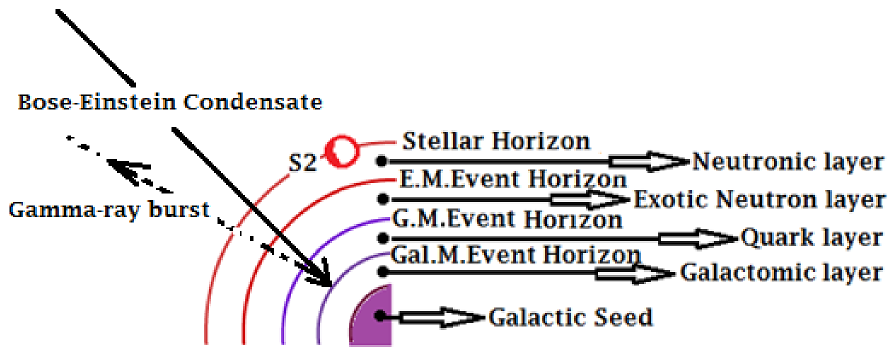


Figure 11-19-2-2

Figure 11-19-2-2 show how gamma ray burst occur.

According to CFLE theory material absorption by galactic Seed at age of galaxy genesis or collapse of Bose-Einstein condensate by galactic activity dense neutron and dense exotic neutron can implode into gluo-magnetic event horizon (inside of Black Hole!!!) and can explode to quasar horizon $\sim 10^{15}m$ with huge energetic gamma ray. Because Einstein's general relativity is only theory of electromagnetic relativity, this theory cannot explain phenomenon of gamma ray burst that follow theory of gluo-magnetic relativity.

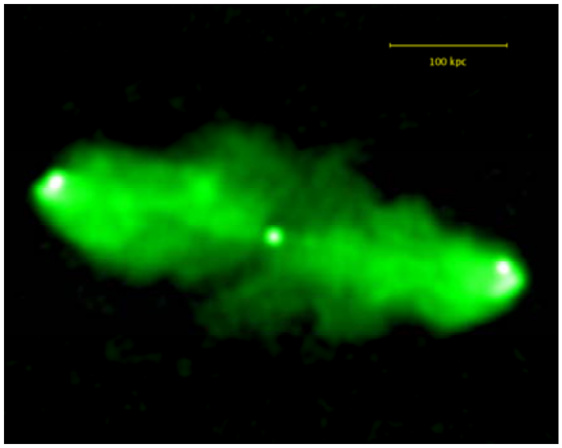
11.20. Galactic Activity

According to correspondence principle of CFLE theory galaxy has to have periodical galactic activity as the periodical sun's activity

The sun as one of radio source is supplied with energy from inertial interaction.

However, strong radio source associated with elliptical galaxies are supplied with energy from active galactic nuclei via plasma beams.

Such supplied energy is occurred by galactic inertial interaction same as solar inertial interaction according to CFLE theory.



3C452

Figure 11-20-1

Radio source, jets and hot spots are produced by continuous activity.

The total spectra of the active radio sources are usually well-approximated by a power law over a wide range of frequencies. Spectral breaks at high-frequency, with a moderated steepening of the spectrum are also often observed.

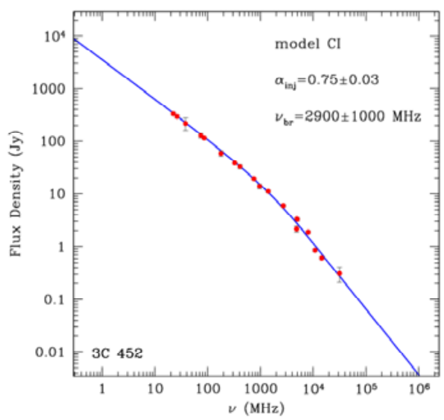


Figure 11-20-2

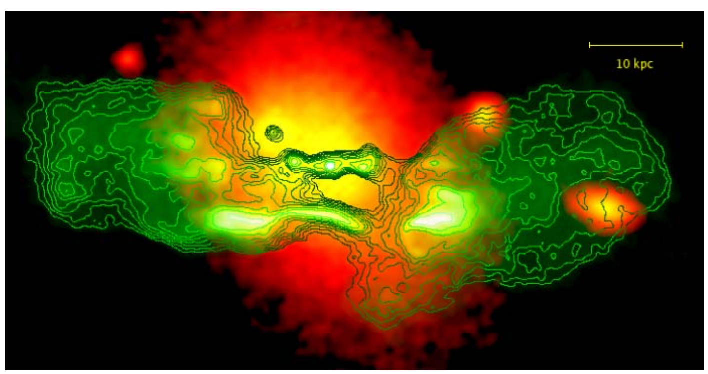
During the active phase the source is continuously replenished of fresh particles. Due to the radiativelosses,the high-frequency spectrum to steepen beyond a btime-dependent break frequency.

When the activity in the nuclei stops or falls to such a low level that the plasma outflow can no longer be sustained, the radio source is expected to undergo a period of fading (the dying phase) before disappearing completely. In the dying phase, radio core, well-defined jets and compact hot spots will disappear because they have to be sustained by continuing activity. On the other hand, the radio lobes may remain detectable for a long time if they are subject only to radiativelosses.

However, only a handful of dying galaxies in this evolutionary stage is known. Here, meaning of dying galaxy is not same meaning of dying star as supernova. Meaning of dying galaxy is only that state of the galaxy is in last phase of galactic activity.

Only few percent of the radio sources in the B2 and 3C samples have the characteristics of a dying radio galaxy (Giovannini et al. 1988). The first unambiguous example of such source was given in Cordey (1987) and up till now only few other sources have been found (Venturi et al. 1997).

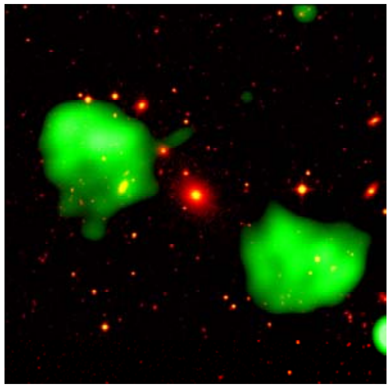
As restarting sun's activity, it is also possible that radio galaxies may be active intermittently; in that case one may find fossil radio plasma left over from an earlier phase of activity, while newly restarted core and jets are visible as well (e.g. 3C 338)



3C 338 B2 0924+30 VLA+DSS

Figure 11-20-3

Dying radio galaxies are more easily detected at low radio frequencies; therefore, the WENSS at 325 MHz is particularly well-suited to search for these elusive objects.



B2 0924+30 VLA+DSS

Figure 11-20-4

Conclusions by Matteo Murgia and his collaborators:Paola Parma,Hans de Ruiter,Roberto Fanti,Karl-Heinz Mack,Federica Govoni,Maxim Markevitch,Andrea Tarchi at National Institute for Astrophysics, Italy are :

●they expect the existence of a large population of

dying radio sources that have been missed from the

current surveys because of their very steep spectra.

●These sources are very faint at centimeter wavelengths

but should still be visible at frequency below 100 MHz if

they are only subject to radiative losses.

●Due to its sensitivity and angular resolution the LOFAR

represents the ideal instrument to discover and study in

detail these elusive objects.

Deep VLA observations performed in various configurations and

frequencies confirmed that of these canditates are:

●8 dying radio galaxies and 4 restarting sources

●2 unresolved sources (LS<10kpc) with an unusual steep spectrum.