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Quasar's Gyro-gravity Behavior, Luminosity and Redshift.

Described by using
the Maxwell Analogy theory.

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Abstract

The high redshift value of quasars is generally described by the Hubble constant, related to the Doppler-effect due to the expansion of the universe. In this paper, we look closer to the part of the redshift that is caused by gyro-gravitation, which is the analogue application of the electromagnetic Maxwell equations upon gravitation.
The result of our analysis explains the possibility of a high value difference between the quasar redshift and the related galaxy redshift due to the quasar's rotation (spin). Moreover, we find results that are within the observed redshifts, based only on the expected quasar-radius of a few light-weeks, without the artifact of an expanding universe.

Key words : *quasar, gravitation, luminosity, gyrotation, galaxy.*
Method : *analytic.*

1. Pro Memore : Maxwell Analogy equations in short, symbols and basic equations.

The formulas (1.1) to (1.6) form a coherent set of equations, similar to the Maxwell equations. The electrical charge q is substituted by the mass m, the magnetic field $\boldsymbol{B}$ by the *Gyrotation* $\boldsymbol{\Omega}$, and the respective constants as well are substituted (the gravitation acceleration is written as $\boldsymbol{g}$ and the universal gravitation constant as $G = (4\pi\ \zeta)^{-1}$. We use sign $\Leftarrow$ instead of = because the right hand of the equation induces the left hand. This sign $\Leftarrow$ will be used when we want to insist on the induction property in the equation. $\boldsymbol{F}$ is the induced force, $\boldsymbol{v}$ the velocity of a mass m with density ρ. The operator $\times$ symbolizes the cross product of vectors. Vectors are written in bold.

$$\boldsymbol{F} \Leftarrow m\,(\boldsymbol{g} + \boldsymbol{v} \times \boldsymbol{\Omega}) \qquad (1.1)$$

$$\nabla\ \boldsymbol{g} \Leftarrow \rho / \zeta \qquad (1.2)$$

$$c^2\ \nabla\times\ \boldsymbol{\Omega} \Leftarrow \boldsymbol{j} / \zeta + \partial \boldsymbol{g} / \partial\, t \qquad (1.3)$$

$$\mathrm{div}\ \boldsymbol{\Omega} \equiv \nabla\ \boldsymbol{\Omega} = 0 \qquad (1.4)$$

$$\nabla\times \boldsymbol{g} \Leftarrow -\partial\, \boldsymbol{\Omega} / \partial\, t \qquad (1.5)$$

$$\mathrm{div}\,\boldsymbol{j} \Leftarrow -\partial\rho / \partial\, t \qquad (1.6)$$

where $\boldsymbol{j}$ is the flow of mass through a surface.
All applications of the electromagnetism can from then on be applied on the *gyrogravitation* with caution. Also it is possible to speak of gyrogravitation waves.

2. Rotation of galaxies and quasars.

Quasars are seen as the originator of galaxies. The jets of matter from surrounding nebulae or accretion discs are projected at high speed from each side of the quasar rotation axis and form spinning nebulae. The projected matter that is situated quite far from the quasar's both poles will hold up the new projected matter in order to form a kind of spinning bar along the quasar's spinning axis, with at each end, a spinning knot, and in the middle the slowly dying quasar.

2.1. Angular momentum of a galaxy.

When I have calculated the velocity of the stars in a galaxy, based on a certain simple mass distribution, I found a simple relationship between the bulge's mass and radius, and the velocity of the stars.
In "A coherent dual vector field theory for gravitation", I found the velocity of the stars in a disc galaxy as :

$$\boldsymbol{v}_{\boldsymbol{R}}^{2} = \frac{\boldsymbol{G}\,\boldsymbol{M}_{0}}{\boldsymbol{R}_{0}}$$ wherein M_o is 10 % of the total mass M and R_o is the radius of the bulge. (2.1)

The angular momentum of the galaxy can be found as follows: $\Delta\boldsymbol{L} = \omega\,\Delta\boldsymbol{I} = \frac{\boldsymbol{v}}{\boldsymbol{R}_i}\,\Delta\boldsymbol{I}$ (2.2)

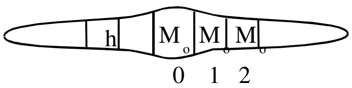


Fig. 2.1. *The disc galaxy after collapsing of the orbits.*

The velocity v is constant and corresponds to (2.1). The mass distribution is supposed to be the quantity of the bulge's mass M_o every step of R_o . This means that between every R_i and R_{i+1} we find a mass M_o (see fig. 2.1). The inertial momentum of a ring shaped part of the disc is

$$\Delta\boldsymbol{I} = \boldsymbol{R}_i^2\,\Delta\boldsymbol{M}_i = \boldsymbol{R}_i^2\,\boldsymbol{M}_0 \qquad (2.3)$$

at a position i in the bulge (see fig. 2.1). To fix the ideas, we take the galaxy's overall radius $R = 10\,R_o$.

We find the angular momentum of the galaxy by making the sum of (2.2) by using (2.3).

Since $\boldsymbol{R}_i = (\boldsymbol{i}+\mathbf{1})\,\boldsymbol{R}_0$, we find $\boldsymbol{L} = \boldsymbol{M}_0\,\boldsymbol{R}_0\,\boldsymbol{v}\sum_{i=0}^{9}(\boldsymbol{i}+\mathbf{1}) = \mathbf{55}\sqrt{\boldsymbol{G}\,\boldsymbol{M}_0^3\,\boldsymbol{R}_0}$ (2.4)

When we make the sum of (2.3) , we get $\boldsymbol{I} = \boldsymbol{M}_0\,\boldsymbol{R}_0^2\sum_{i=0}^{9}(\boldsymbol{i}+\mathbf{1})^2 = \mathbf{385}\,\boldsymbol{M}_0\,\boldsymbol{R}_0^2$ (2.5)

and since $\boldsymbol{L} = \omega\,\boldsymbol{I}$, we find the average value for the galaxy's angular velocity ω_g :

$$\overline{\omega}_{\mathbf{g}} = \frac{\mathbf{55}}{\mathbf{385}}\sqrt{\frac{\boldsymbol{G}\,\boldsymbol{M}_0}{\boldsymbol{R}_0^3}} \qquad (2.6)$$

Or, in figures : $$\overline{\omega}_{\mathbf{g}} = \mathbf{7.24\cdot 10^{-13}\ rad/s} \qquad (2.7)$$

(Instead of the sums in (2.4) and (2.5) , we should have put integrations which would result in the quotient 50/333 instead of 55/385 . However, this doesn't make any difference in the general discussion).

For our Milky Way, we took the reasonable estimate of a bulge diameter of 10000 light years having a mass of 20 billion of solar masses.

2.2. Angular momentum and angular velocity of a quasar.

The mass and the angular momentum of both the galaxy and the corresponding quasar are of the same order because there is a limited loss of mass in time.

We could consider a quasar as a sphere, but, due to my former work, I have found out that the shape should be a torus. But since we speak of orders of magnitude, it doesn't change much anyway.

Thus, for the quasar, the same value of $\boldsymbol{L}$ is valid.

We can write, in general : $\boldsymbol{L}_{\mathbf{galaxy}} = \boldsymbol{L}_{\mathbf{quasar}} = \boldsymbol{M}_{\mathbf{q}} \boldsymbol{R}_{\mathbf{q}}^{2} \omega_{\mathbf{q}}$ (2.8)

Since the total mass remained the same : $\boldsymbol{M}_{\mathbf{q}} = \mathbf{10}\, \boldsymbol{M}_{\mathbf{0}}$, (2.9)
we have to find out the other parameters.

The observation of quasars suggests that the radius of a quasar could be as small as a few light-weeks. Just to fix an order of magnitude that is generally accepted (in fact even lower radii are supposed) we'll take a radius of 16 light-weeks, which is $1.45 \cdot 10^{12}$ m.
We get now only two subordinated parameters left, the mass density and the mass velocity, which both are interdependent.

A second important observation of stars resulted in the fact that the equatorial angular velocity is much slower than the internal angular velocities. Since quasars have the shape of a torus (see my earlier paper "On the geometry of rotary stars and black holes") , we can in a first approximation also assume that the velocity of the matter in the quasar is nearly constant.

Hence, assuming that the velocity is 10% of the speed of light : $\omega_{\mathbf{q}} = \dfrac{\boldsymbol{v}}{\boldsymbol{R}_{\mathbf{q}}} = \dfrac{\boldsymbol{c}}{\mathbf{10}\, \boldsymbol{R}_{\mathbf{q}}}$ (2.10)

We chose this velocity just as an example, because this is a free parameter in these calculations, and we will calculate the corresponding density of the quasar. If the result is reasonable compared with the chosen mass' velocity, we can form a basis for further research with the gyro-gravitation theory (or Maxwell Analogy for Gravitation).

To the benefit of simple calculations that we do here to find out if the found density is of a credible order of magnitude, we will assume that quasars are ideal fluids and that their density is equal over the whole object.

Let us write the moment of inertia of the quasar about its spin axis as : $\boldsymbol{I}_{\mathbf{q}} = \kappa \boldsymbol{M}_{\mathbf{q}} \boldsymbol{R}_{\mathbf{q}}^{2}$ (2.11)
wherein κ is a figure of order zero (10^0) that depends on the exact shape of the torus.

Then $\boldsymbol{I}_{\mathbf{q}} = \pi \kappa \kappa' \rho_{\mathbf{q}} \boldsymbol{R}_{\mathbf{q}}^{5}$ wherein κ' also is a figure of order zero (10^0) that depends on the exact shape of the torus and ρ is the constant density in the quasar.

And thus : $$\mathbf{d} \boldsymbol{I}_{\mathbf{q}} = \pi \kappa \kappa' \rho_{\mathbf{q}} \boldsymbol{r}_{\mathbf{q}}^{4} \mathbf{d} \boldsymbol{r}_{\mathbf{q}} \qquad (2.12.a.b)$$

For the angular momentum we find when using (2.10) and after integration to $\boldsymbol{r}$, between zero and $\boldsymbol{R}_{\mathbf{q}}$:

$$\boldsymbol{L}_{\mathbf{quasar}} = \boldsymbol{I}_{\mathbf{q}} \omega_{\mathbf{q}} = \frac{\mathbf{1}}{\mathbf{8}} \pi \kappa \kappa' \rho_{\mathbf{q}} \boldsymbol{c} \boldsymbol{R}_{\mathbf{q}}^{4} \qquad (2.13)$$

So, when using (2.11) , knowing that the angular momenta of the quasar and the galaxy are equal, and when using the integrated version of (2.4) -see the remark after equation (2.7)- :

$$\rho_{\mathrm{q}} = \frac{8\,L_{\mathrm{galaxy}}}{\pi\,\kappa\,\kappa'\,c\,R_{\mathrm{q}}^4} = \frac{400\sqrt{G\,M_0^3\,R_0}}{\pi\,\kappa\,\kappa'\,c\,R_{\mathrm{q}}^4} \tag{2.14}$$

In figures, when assuming that $\kappa = \kappa' = 1$, this gives : $\rho_{\mathrm{quasar}} = 4.35 \cdot 10^4\ \mathrm{kg/m^3}$. (2.15)

3. The gamma-ray production of quasars.

It seems maybe strange that we have chosen a mass' velocity as large as 10% of the speed of light. However, the observed large jets of quasars make us believe that the velocity should be high. Hereafter follows the relationship.

At the quasar's surface, the high speed of matter creates a huge inwards force due to the gyrotation force that is given by the second part of the equation (here, it is written down for a ring-shaped object) :

$$a_x = R\,\omega^2 \cos\alpha \left[1 - \frac{G\,m\left(1 - 3\sin^2\alpha\right)}{2\,R\,c^2}\right] - \frac{G\,m\cos\alpha}{R^2} \tag{3.1}$$

The first part is the centrifugal force (inertia resistance), the third is the pure gravitation. The equation shows only the force along the x-axis that is perpendicular to the spin axis. The angle α is the angle compared to the equator. Equation (3.1) is taken from my paper "On the geometry of rotary stars and black holes", equation (3.3) , wherein the spherical inertial moment has been replaced by a ring-shaped inertial moment.

Below a certain value of α, the global acceleration a_x will be directed inwards for an unlimited angular velocity, provided that for the quasar's radius we have :

$$R_{\mathrm{q}} < G\,M_{\mathrm{q}} \big/ \left(2\,c^2\right) \tag{3.2}$$

With the figures of chapter 2, we come indeed to the validity of (3.2) , what means that the quasar that would be deducted from our galaxy would be compressed without exploding in a certain zone, which is defined by –35°16' > α > 35°16'.

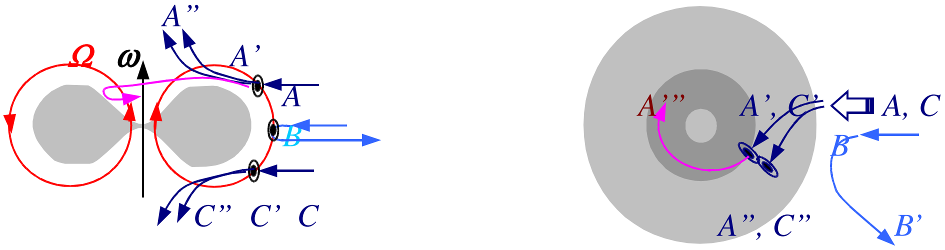
In the former chapter, we have chosen a quasar's radius that is of the order of magnitude of the generally observed quasars, and which is small enough to maintain the quasar together spites the high rotation speed. Moreover we have chosen a radius that -mechanically speaking- allowed matter to spin at very high speeds (instead of 10 % of the speed of light, the actual speed might even be much higher) . So, we might wonder why the observed emission of X-rays couldn't simply be due to matter that got disintegrated into gamma rays due to this high speed, on top of the gamma rays from the jets. The large gyro-gravitational forces made that the redshifted gamma-rays became X-rays to us.

Although there is no direct proof for this point of view, it is an interesting hypothesis because it makes fit together quite a number of puzzle pieces.
The high luminosity of quasars can also be explained by this disintegration, provided that the light would be able to escape. And we can check that. The quasar is indeed never a full black hole because we proved in "On the geometry of rotary stars and black holes" that the maximal possible explosion-free zone is –35°16' > α > 35°16'. This means that light will escape outside this zone anyway.
Remark that the produced gamma-rays will not be mechanically bound with the quasar any more.

The non-explosion-free zone of the quasar is then the originator of mass losses that forms a nebula environment around the quasar.

The quasar's spin will drive nebulae matter to the equator-level as an accretion-ring, where the gyrotation forces are the largest, but also to the poles-levels the remains nebulae matter, where the gyrotation forces are the lowest.

The jets are formed by the gyro-gravitational propulsion that is explained in “A coherent dual vector field theory for gravitation” , where we can apply the vector multiplication of equation (1.1).
When the matter of the accretion ring approaches the radial way, it deviates in retrograde direction (for particle *A’* and *C’*). See fig. 3.1 top view. With fast rotating heavy masses this acceleration is enormous. Then, when the



side view Fig. 3.1 *top view*

Power jets produced by gyro-gyrotational action on the quasar's accretion disc.

particles go by retrograde way, again an acceleration is exerted on the particles in another direction (particles *A”, C”*). As a consequence these particles are projected away from the poles.

Finally, the jets are stopped by the nebulae along the spin axis, where they are enlightened.

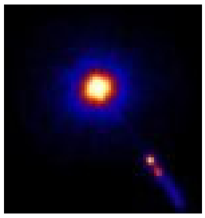


Fig.3.2. *X-ray picture of quasar.*
Credits :RUG

4. Comparative gyro-gravitational redshift of the galaxy and the quasar.

Since both the galaxy and the quasar have nearly the same mass, the Newtonian gravitational redshift of both the galaxy and the corresponding quasar are of the same order as well.

But let us look at the gyrotational redshift. In “The calculation of the bending of star light grazing the sun.” equation (2.6), the force working on light grazing the sun has been calculated.

Of this equation, the first one is of pure gravitational origin, the last one is purely dependent from the angular velocity of the sun. Analogically, we use that part of the equation for the galaxy and the quasar and we find the respective accelerations (adapted for ring-shaped objects) :

$$\boldsymbol{a}_{\mathrm{g}} = \frac{\boldsymbol{F}_{\mathrm{g}}}{\mathbf{m}} = -\frac{2\,G\,M_{\mathrm{g}}}{r_{\mathrm{g}}^{2}}\left(1+\frac{\kappa_{\mathrm{g}}\,R_{\mathrm{g}}^{2}\,\omega_{\mathrm{g}}^{2}}{4\,c^{2}}\right) \qquad \boldsymbol{a}_{\mathrm{q}} = \frac{\boldsymbol{F}_{\mathrm{q}}}{\mathbf{m}} = -\frac{2\,G\,M_{\mathrm{q}}}{r_{\mathrm{q}}^{2}}\left(1+\frac{\kappa_{\mathrm{q}}\,R_{\mathrm{q}}^{2}\,\omega_{\mathrm{q}}^{2}}{4\,c^{2}}\right) \qquad (4.1.a.b)$$

wherein $\kappa_{\mathrm{g,\,q}}$ is a figure of order zero (10^{0}) that depends on the exact shape of respectively the galaxy and the quasar.
We have considered the force at the equator-level, thus, the angle α is zero. The parameter r is any radius wherefore $R < r$. The mass m is the mass of light.

The loss of energy of the wave can be expressed in relation to a_{g} and a_{q} (we note now ' g , q ' in one equation, which is valid for both the quasar and the galaxy) :

$$\boldsymbol{h}\,\mathbf{d}\,\upsilon = \frac{\boldsymbol{h}\,\upsilon\,\boldsymbol{a}_{\mathbf{g,q}}}{\boldsymbol{c}^2}\,\mathbf{d}\,\boldsymbol{r} \quad , \quad \text{thus : } \quad \frac{\mathbf{d}\,\upsilon}{\upsilon} = \frac{\boldsymbol{a}_{\mathbf{g,q}}}{\boldsymbol{c}^2}\,\mathbf{d}\,\boldsymbol{r} \tag{4.2.a.b}$$

wherein υ is the frequency of the wave and h the Plank's constant.
Integrating this from R_o to infinity gives (υ_0 is the emitted frequency and υ the observed) :

$$\int_{\upsilon_0}^{\upsilon} \frac{\mathbf{d}\,\upsilon}{\upsilon} = \int_{\boldsymbol{R}_0}^{\infty} \frac{\boldsymbol{a}_{\mathbf{g,q}}}{\boldsymbol{c}^2}\,\mathbf{d}\,\boldsymbol{r} \tag{4.3}$$

We can write (4.1.a.b) in terms of M_o and R_o , and knowing that $M_g = M_q$, $R_g = 10\,R_o$, $R_q = 3.1{\cdot}10^{-5}\,R_o$, we see that all the right hand parameters of (4.1.a.b) are constants, except r . Let us call the group of constants 'A' , then we have after integration of (4.3) the equation for the redshift :

$$\boldsymbol{z} = \frac{\upsilon_0}{\upsilon} - \mathbf{1} = \boldsymbol{e}^{-A/\left(c^2 R_0\right)} - \mathbf{1} \tag{4.4}$$

wherein A is the group of constants in (4.1.a.b) , respectively for the galaxy and the quasar:

$$\boldsymbol{A} = -\mathbf{2}\,\boldsymbol{G}\,\boldsymbol{M}_{\mathbf{g,q}}\left(\mathbf{1} + \frac{\kappa_{\mathbf{g,q}}\,\boldsymbol{R}^2_{\mathbf{g,q}}\,\omega^2_{\mathbf{g,q}}}{\mathbf{4}\,\boldsymbol{c}^2}\right) \tag{4.5}$$

For the galaxy, the gyro-gravitational redshift z is negligible, especially because the escaping light that has lost energy by leaving the galaxy gains the energy back by entering the galaxy of the observer.

The final result for the galaxy's gyro-gravitational redshift is then by definition zero and that of the quasar (in this example, for a quasar-radius of 16 weeks) is (with $\kappa = \kappa' = 1$) :

$$z = 0.06 \tag{4.6}$$

This value is within the range of the observed redshifts for quasars. By taking the quasar's radius a little larger, the redshift decreases.

5. Discussion and conclusions.

How foolish is the idea of matter that can have a velocity of 10 % of the speed of light? Is the plasma of super-dense quasars behaving very differently to allow high densities? To what extend are the equatorial parts of the quasar spinning slower than the inner part, as it is observed with the Sun and with stars, and what causes it? We don't know the answer of these questions, but what we can assume is that the quasar's diameter is only a few light-weeks, that the quasar's density and the spin velocity is very high, and that the origin of the strong jets is related to the former parameters.
The excellent correlation between the quasar's diameter, the related galaxy's angular momentum and the gyro-gravitational redshift is extraordinary, and allows to choose a reasonable set of remaining parameters of density and spin velocity, which are interdependent.
The calculation didn't need any universe expansion theory, and here, the Ashmore redshift[4] has not been taken in account.

6. References

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