On the wave mechanics of galaxies

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Abstract
The consistency in stellar orbital speeds, independent upon their distance from galactic nuclei, is shown to be due to an increase in their angular frequencies.

1. Introduction

The standard gravitational parameter μ for a circular orbit can be determined by

$$[1]\ \mu = G(M + m) = rv^2 = r^3 n^2,$$

where G is the gravitational constant, M is the mass of a primary, m is the mass of a secondary, r is the radius of the orbit, v is the secondary's velocity, and *n* is its mean motion,

$$[2]\ n = \frac{2\pi}{T}$$

where T is a secondary's period. Setting M to $M_\odot$ (one solar mass) and r to an astronomical unit,

$$[3]\ G = \frac{n^2}{(M_\Theta + m)}.$$

What is this telling us about the gravitational constant? When $M_\odot >> m$, as in the case with the bodies in our solar system, the gravitational constant $G \approx n^2$. Since the Gaussian gravitational constant is

$$[4]\ k = \frac{2\pi}{T_D} \approx n \approx \sqrt{G}$$

(in radians per day), $G \approx n^2$ is valid under these assumptions. Setting G to unity results in T = 2π, and when T is set to 1 sidereal year, k ≈ 2π. The gravitational constants k and G are evidently linked to time (being dependent upon the sum of the masses in a 2−body system).

2. The Sun's angular frequency

According to geological evidence[1], the Sun oscillates perpendicular to the galactic plane in 33±1 Myr cycles during its estimated 225−250 Myr revolution period (the duration of its nodal (draconic) period is significantly less than its revolution (sidereal) period). The Sun's angular frequency ω is therefore

$$[5]\ \omega \approx \frac{2\pi}{66\pm2\ \mathrm{Myr}},$$

(33±1 Myr is half of the Sun's nodal period). Revisiting equation [3], T = 2π when the gravitational constant G is set to unity, i.e. T = 1 cycle. Setting the Sun's radius, revolution period, and the mass interior to its orbit to unity, a wave mechanical version of equation [1] can be given as,

$$[6]\ \omega^2 \sum_{i=1}^{n} (\gamma M_{0i} + \gamma m_0) = \vec{r}(t_1, t_2)^3 N^2 n^2$$

where N is a star's wave quantity (the ratio between its revolution and nodal periods), t_1 and t_2 are the temporal dimensions relative to the periods (discussed in the conclusion), and the Lorentz factor γ indicates the relativistic mass of the bodies within a galaxy (the *n* in the summation indicates 1, 2, 3... *n* and not mean motion). According to the estimates given previously, the Sun's wave quantity N ≈ 3.7.

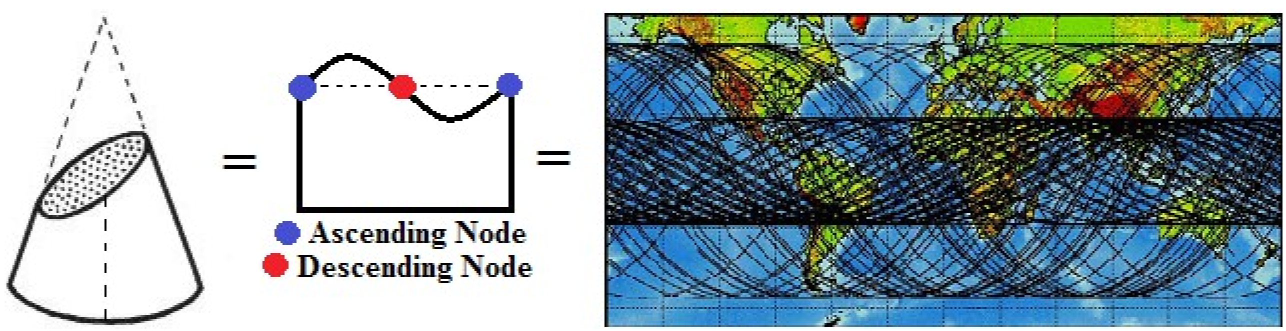

FIG. 1: An elliptical conic section is a sinusoidal wave with N ≈ 1 relative to a 2D plane of reference.

At this point in time, further research needs to be conducted with the planets in our solar system in order to determine if N is dependent upon a secondary's nodal period, apsidal period, or axial period relative to its revolution (sidereal) period. The nodal period was chosen arbitrarily for galactic systems since it can be deduced from physical evidence[1].

3. Conclusion

It is hypothesized that stellar positions will be observed to change helically over time by

$$[7]\ \vec{r}(t_1, t_2) = (r_1 + r_2 \cos(t_2)) \cos(t_1)x + (r_1 + r_2 \cos(t_2)) \sin(t_1)y + r_2 \sin(t_2)z,$$

where r_1 is a star's revolution radius, r_2 is its nodal radius (amplitude), $t_1 \in (0, T_R)$, and $t_2 \in (0, T_N)$, where T_R and T_N are the revolution and nodal periods. Notice that the spacetime dimensions in equations [7] match the spacetime dimensions of the gravitational constant (three spatial and two temporal), whereas Kepler's parametric equations are three dimensional (two spatial and one temporal). The temporal dimension $t_2 = it_1$ (i.e. it is orthogonal to t_1) and ($0 \leq t_2 \leq T_R$) in a bound orbit. Assuming stars furthest from a galaxy's nucleus have higher angular frequencies, their relativistic mass should be greater. If this is observed experimentally, it may shed light on dark matter.

Dedication

This paper is dedicated to Cynthia Cashman Lett, without whom it would not have been possible.

Reference

[1] M.R. Rampino and R.B. Stothers (1984). "*Terrestrial mass extinctions, cometary impacts, and the Sun's motion perpendicular to the galactic plane*," Nature 308, 709 – 712.