Estimated asteroide masses frequently are wrong

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Shortcomings of determination of asteroide masses are highlighted.
Some help here could come from vortical celestial mechanics.

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Определенные массы астероидов часто ошибочны

Коротко обсуждается недостатки методов, применяемых для определения масс астероидов. Помощь может предложить вихревая небесная механика.

Astronomy is constructed from mathematical abstractions, just it was in 1801, when famous German philosopher Hegel launched a life-long attack to Newtonian physics.

For asteroide mass determination astronomers use different indirect methods, however each of them has its problems.

Use of Kepler's Third law in Newton's modification for calculation of mass of primary by orbital movement of secondary typically is considered as reliable method. However, it appeared to be flawed, since here astronomers assume, that solar **MG** as a factor, causing planetary orbital movement, is universal value and masses of other celestial bodies could be proportionally derived from comparison of orbital geometry and orbital speed of secondaries.

In alternative theory, self-rotation of central body creates vortex (fig.1, see Wang, 2012), which transfers angular momentum trough the space. Simplified Cartesian approach may look like

$$\mathbf{M*\omega_{eq}*k = 4*\pi^2*A^3/P^2}$$

(Keplerian proportion $\mathbf{A^3/P^2}$ now is connected not simply with mass **M** of central body, but also with it's equatorial rotation speed $\boldsymbol{\omega_{eq}}$ and coefficient **k**, which shows effectivity of creation of vortex by self-rotation of primary).

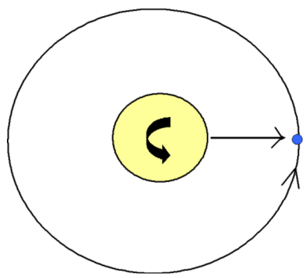

Fig. 1 Real meaning of Newton's modification of Kepler's Third law-DesCartes vortex.

As volumes of celestial bodies are known better, we can write mentioned equation as

$$V*d*\omega_{eq}*k = 4*\pi^2*A^3/P^2$$

were **V-** volume, **d-** density of central body. Operating with SI units, values of **d*k** from left side of equation gives us remarkably different numbers, indicating conceptual error in Newtonian approach (table 1):

Primary	**Volume V, m^3**	**Equatorial rotating speed, ω_{eq} rad/sec**	**Secondary**	**Mean orbital distance A, m**	**Period P, sec**	**k* d**
93 Minerva	1.48E+15	2.92E-04	Gorgoneion	3.75E+05	9.59E+04	1.33E-05
45 Eugenia	5.12E+15	3.06E-04	Petit Prince	1.18E+06	4.12E+05	6.19E-06
216Kleopatra	1.03E+16	3.25E-04	Alexhelios	6.78E+05	2.01E+05	2.32E-06
Haumea	1.10E+19	4.44E-04	Hi'iaka	4.99E+07	4.32E+06	1.36E-06
Earth	1.08E+21	7.22E-05	Moon	3.84E+08	2.36E+06	**1.30E-04**
Uranus	6.83E+22	1.00E-04	Miranda	1.29E+08	1.22E+05	2.11E-05
Neptune	6.25E+22	1.08E-04	Proteus	1.18E+08	9.69E+04	2.56E-05
Saturn	8.27E+23	1.67E-04	Mimas	1.85E+08	7.78E+04	7.60E-06
Jupiter	1.43E+24	2.31E-04	Io	4.22E+08	1.53E+05	9.76E-06
Sun	1.41E+27	2.92E-06	Mercury	5.79E+10	7.60E+06	**8.16E-04**

Table 1. Proportional calculations of some two body systems.

We see, that solar vortex is very effective in comparison with vortices of Jovian planets and that of true space rocks like small planet Haumea and asteroids in first lines of table 1. Connection between self-rotation of the Sun and orbital movement of planets is not appropriate as cosmological standard as far we deal with small planets, asteroides and dwarf asteroides. Next unaccounted point is, that orbital movement of secondary should be influenced also by proportion of diameters of primary and secondary. In solar system example solar diameter is 1 392 000 km and diameter of Mercury- 4879 km (proportion 285:1). In Earth- Moon system mentioned proportion is 3.67:1, in Sila-Nunam system- 1.06. Errors in estimated densities in latter cases are obvious.

As illustration here be mentioned obviously wrong estimated densities of

283 Emma	estimated density	0.81
87 Sylvia	estimated density	1.20
79360 Sila	estimated density	0.72
379 Huenna	estimated density	0.9
617 Patroclus	estimated density	0.88

using this method.

Next speculative approach of astronomers includes reflectance spectroscopy of asteroides (Binzel). Reflected spectra is compared with that of meteorites and meteorite data are extrapolated to asteroid. Very approximate method. How wrong it could be, shows example of asteroid 16 Psyche. From observations of surface of asteroid astronomers concluded, that 16 Psyche contain a lot of metal. Somebody felt during analysis process, that celestial body with density around 7.8 will sound too exotic, so by use of porosity, astronomers „reduced” density of Psyche till 4.5- faulty still, as we will see further. In Baer and Chesley (2008) we can see some space rocks with estimated density over 6.0, but not in Wikipedia.

Ballistic analogy (fig 2) in asteroide mass determination suffers from poor understanding of celestial mechanics.

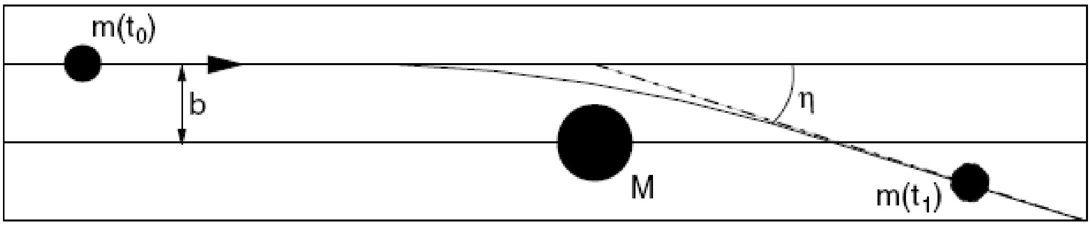

Fig.2 Ballistic analogy in perturbation theory. After Hilton.

$$\tan \frac{1}{2}\theta = \frac{G(m + M)}{v^2 b}$$

θ is the angle of deflection in the center-of mass frame of reference, **m** is the mass of one body, **M-** is the mass of other body, **G** is the gravitational constant, **v** is the relative velocity of the encounter, **b** is the impact parameter (fig.2).

First, space gravity is connected with volume of central body, not mass (Mathis, 2010). Second, use of „gravitation constant" here is unfounded.

Use of perturbations as a method for determining masses of asteroids could be valid method because nongravitational asteroid-asteroid interaction theoretically depends from its mass and surface area only. However, astronomers consider tidal forces as related with gravity, what is unfounded. Fast rotation of asteroide may add some additional weight to perturbing ability of it.

Astronomers consider their density estimation methods as sacrosanct in spite of idiotic results they yield. Thus *Nature News* from November 13, 2013 comes with a headline „*Astronomers surprised by large space rock less dense than water*" (Cowen, 2013). Similarly, Brown (2013), error of which resulted in demotion of Pluto as a planet, tells us about Kuiper belt objects with densities of $0.5 g/cm^3$ and that „*clear trend has emerged: the smaller objects have low densities, while larger objects have increasingly higher densities*". Most likely however this is methodic blunder, not new page in development of planetary science.

Attitude of astronomers is understandable, because their celestial mechanics is mathematical abstraction only. In real celestial mechanics celestial bodies feel real forces, so perhaps I should offer two teorems:

1. here is no celestial body with density below 1.0,
2. here is no celestial body with macroporosity over 20%.

Help in certain extent here can offer vortical celestial mechanics. Heaviest objects generally should be closer to Sun (cf.Wang, 2012). Thus, for example, it is not possible, that asteroid 16Psyche has density 4.5 beeing 2.9 AU from the Sun while the Earth hardly has such a high density, beeing 1 AU from the Sun.

Alternative determination of densities of asteroids than consist of several stages:

1) getting reliable estimations of densities of Venus, Earth and Mars,

2) making an „calibration line", following the idea, that, for example, near Earth object with semi-mayor axis 1 AU should have same density as Earth,

3) making „renormalisation" of inclined orbits in the spirit of Kozai-Lidov mechanism. Kozai and Lidov catched the idea of interconnectedness of orbital eccentrity (orbital elongation) and orbital inclination for relative large inclinations. Process, however, proceeds

also by smaller inclinations- vortex of central body tends to remove secondary body from equatorial level, but „gravitomagnetic” component (DeMees, 2003) counteracts (fig.3).

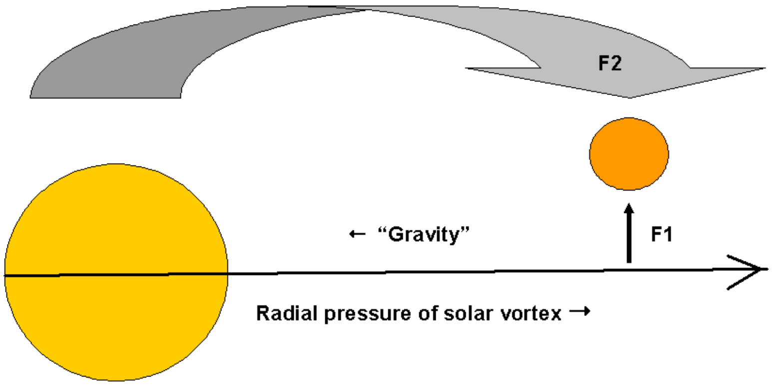

Fig.3 Assumed interplay of solar vortex and gravitomagnetic force F2.

Thus correction for Venus is small (orbital eccentricity 0.007, orbital inclination 3.86 degrees against solar equator). The Earth is more complex story, since, according the autor's wievpoint, larger orbital eccentricity (0.017) and orbital inclination of the Earth (7.16 degrees against solar equator) in comparison with Venus arose from action of terrestrial vortex. Thus „true” place for the Earth as a nearly dead space rock (from geophysics textbooks) should be around 147 million kilometers from the Sun.

Assuming densities of Venus, Earth and Mars- 4.5, 4.0 and 3.0, respectively, we can see, for example, that densities of near earth objects 99942 Apophis and 3122 Florence could be underestimated. 22.1 degree orbital inclination of 3122 Florence could be alternatively considered as coefficient 1.22 for increasing of orbital distance in the course of "renormalisation". "Renormalised" mean orbital distance of 3122 Florence than is 2.14 AU, what for typical space rock resulted in density over 2.0.

References

Baer J., Chesley S. (2008) Astrometric masses of 21 asteroids, and an integrated asteroid ephemeris. *Celestial Mechanics and Dynamical Astronomy*, **100**, 27–42.
Binzel R. *Can NEAs be Grouped by Their Common Physical Characteristics*? Internet presentation.
Brown, M. (2013) The density of mid-sized Kuiper belt object 2002 UX25 and the formation of the dwarf planets. *ApJ*, in press
Coven R. (2013) Astronomers surprised by large space rock less dense than water. *Nature News*, 13 November 2013.
DeMees T. (2003) *Lectures on "A coherent dual vector field theory for gravitation".* Internet.
Hilton J. *Asteroid masses and densities*. Internet.
Kozai Y. (1962). Secular perturbations of asteroids with high inclination and eccentricity. *The Astronomical Journal*, **67**, 591.
Lidov M. (1962). The evolution of orbits of artificial satellites of planets under the action of gravitational perturbations of external bodies. *Planetary and Space Science*. **9**, 719–759.
Mathis M. (2010) *Un-unified field and other problems*. Author House.
Wang H. (2012) *Vortex and Kepler's third Law*. viXra