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The drift of Mercury's perihelion determined with Ether physics (revised)

Chris Essonne, chrisessonne0@gmail.com, May 2023

Abstract
The explanation of the drift of Mercury’s perihelion is considered as one proof of the validity of Einstein’s Theory of General Relativity, since no explanation with Newtonian physics has been found yet. This paper determines the drift of Mercury’s perihelion based on the understanding of the concept of mass in Ether Physics, which can vary in an Ether pressure field. The result obtained is a drift of 38.8 arcsecond/century, in perfect agreement with the measurements published by Le Verrier in 1859 and then by Newcomb in 1895.

Keywords
Ether Physics, General Relativity, Variable mass, Drift of Mercury’s perihelion

Introduction
Nicolas Tesla was one of the most ardent opponent of the general relativity theory, arguing that *“All literature on this subject is futile and destined to oblivion. So are also all attempts to explain the workings of the universe without recognizing the existence of the ether and the indispensable function it plays in the phenomena”*.
In a series of 6 papers, the author has demonstrated that gravity, electromagnetism, mass, the strong nuclear force, the famous equation $E=m.c^2$ and the escape velocity of a celestial body can be derived from the presence an Ether pressure field.
In two previous papers, the author gave first a preliminary study showing the strong similarities between the relative variation of the pressure field in a gravity field compared to the relative variation of the perihelion for a planet with an elliptic orbit, followed by a theoretical evaluation of this drift.
This paper will go deeper with a more accurate theoretical determination of this drift strictly based on Newtonian physics, and the result is extraordinarily close to the result given by observations and by the general relativity theory.

Background
Until 1905, vacuum was considered full of ether although Michelson and Morley officially failed to demonstrate its existence in 1887, with their assumption of Earth moving in a fixed Ether. But according to Ref [3] page 57, they measured an Ether wind between 5 and 7.5 km/s while Dayton Miller, a physicist that continued and improved the measures, published in1928 his results obtained at Mount Palomar that were between 9.2 and 11.3 km/s (Ref [3], page 109).
Ref [5] shows the Ether penetration velocity is equal to the escape velocity, which is 11.2 km/s for the Earth, very close to the maximum result obtained previously by Dayton Miller.

Ref [1] demonstrates that the assumption that gravity is the gradient of Ether pressure brings the same results concerning the variations of coordinate ct as the Schwarzschild metric, solution of Einstein’s equation for a non rotating and isolated star, at the difference that c varies instead of t.

Main results of Ref [1] are the following :

$$\vec{g}=-\frac{c^2}{2.P_0}\overrightarrow{grad\,P} \qquad (1)$$

where c, P_0 are respectively the speed of light and the ether pressure far away from any mass

and also $$\frac{c^2}{P_0}=\frac{c^2(r)}{P(r)} = \text{constant} \qquad (2)$$

$c(r), P(r)$ being the modified values of c, P_0 in a gravity field at distance r from the center of a celestial body.
The formula of vacuum pressure outside a celestial body far away from any other mass :

$$P(r)=P_{0.}(1-\frac{2GM}{c^2.r}) \qquad (3)$$

gives back the well known formula of Newtonian gravitation when combined with (1) :

$$\vec{g}=-\frac{GM}{r^2}\vec{u_r} \qquad (4)$$

with *G* gravitational constant, *M* mass of the star, *r* distance to the center of the star, and $\vec{u_r}$ symmetrical axis in spherical coordinates.

Official science states that particles have no intrinsic mass, but get their mass by the coupling with the Higgs field of the vacuum. Ref [4] based on Ref [6] paragraph 678, reminds that an accelerated body plunged into a perfect fluid under pressure P behaves as if it had an additional apparent mass, due to the resistance of the pressure forces to the acceleration of that body. In the special case where pressure P is homogeneous and constant, this apparent mass is proportional to the volume density of the fluid and to a form factor of the body.

Drift of the perihelion of a celestial body having an elliptic orbit around a star

Let's take two celestial bodies, a star and a planet orbiting around the star.
The gravity field due to the star has a spherical symmetry, and the Ether pressure P around the star depends only on the distance r to the center of the star as stated in (3).

If a planet has a circular orbit around its star, the pressure field P(r) of the vacuum as long as the velocity of the Ether stream all along the circular orbit, are constant, and thus the mass of the planet is constant.

As stated above, Ref [6] gives the value of the apparent mass of an accelerated body in the special case of a homogeneous constant pressure field, apparent mass which appears to be independent of the pressure P itself. But, in the general case of a variable pressure field such as in a gravity field according to (1), there is no reason for the mass to be constant.
On the contrary, since mass is now understood as the coupling of a particle with the ether pressure field, the higher the pressure, the higher the coupling, and no coupling is expected in an empty field.
Thus, we assume a linear relation between apparent mass and pressure in a perfect fluid such as the ether and consequently :

$$\frac{dm}{m}=\frac{dP}{P} \qquad (5)$$

According to General Relativity, the relative variation of the perihelion over one turn for a planet in orbit around a star is given by the following formula :

$$\frac{\Delta\theta}{2\pi}=\frac{3GM}{c^2 a(1-e^2)} \qquad (6)$$

with
e : eccentricity of the orbit of the planet
a : semi-major axis of the orbit of the planet
b : semi-minor axis of the orbit $b=a\sqrt{1-e^2}$ will be used later in this paper
M : mass of the star

Applied to planet Mercury :
a = 57.9 million km = 57.9 10^9 m
e = 0.206
M mass of the Sun = 2 10^{30} kg
(6) gives a relative variation of 8. 10^{-8}

Let's now evaluate the relative variation of the Ether pressure field along the orbit according to (1) applied for the perihelion and the aphelia :

For the perihelion, $$r=a(1-e) \qquad (7)$$

and $$P_1=P_{0.}(1-\frac{2GM}{c^2.a.(1-e)}) \qquad (8)$$

For the aphelia, $$r=a(1+e) \qquad (9)$$

and $$P_2=P_{0.}(1-\frac{2GM}{c^2.a.(1+e)}) \qquad (10)$$

The relative variation of pressure $\frac{\Delta P}{P}$ is close to $\frac{\Delta P}{P_0}$:

$$\frac{\Delta P}{P_0}=\frac{(P_2-P_1)}{P_0}=\frac{2GM}{c^2.a}.(\frac{1}{1-e}-\frac{1}{1+e}) \qquad (11)$$

$$\frac{\Delta P}{P_0}=\frac{4e.GM}{c^2 a(1-e^2)} \qquad (12)$$

The demonstration of Kepler laws given in Ref [7] relies on the basic principle of dynamics, assuming the mass m of the planet is constant.

$$\Sigma Forces=\frac{dp}{dt}=\frac{d(mv)}{dt}=m\frac{dv}{dt} \qquad (13)$$

Taking into account a possible variation of the mass of the planet due to the variation of Ether pressure along the orbit, the correct demonstration should be based on :

$$\Sigma Forces=\frac{dp}{dt}=\frac{d(mv)}{dt}=m\frac{dv}{dt}+\frac{dm}{dt}v \qquad (14)$$

Which can also be formulated :

$$m\frac{dv}{dt}=\Sigma Forces-\frac{dm}{dt}v \qquad (15)$$

The last term can be seen on an additional external force that will provide some extra work on the planet along its orbit. The term $\frac{dm}{dt}$ is positive when the planet travels from its perihelion towards its aphelia and this apparent force is a resistive force, since the pressure field increases with (r). $\frac{dm}{dt}$ is negative when the planet travels from its aphelia towards its perihelion since the pressure field decreases in that case., and this apparent force is a propulsive force on this part of the orbit.

Work provided by this external force :

On the path Perihelion to Aphelia, : $\vec{F}$ and $\vec{v}$ have opposite directions and :

$$W_1=\int_{r_{min}}^{r_{max}}\vec{F}\vec{v}\,dt=\int_{r_{min}}^{r_{max}}\frac{-dm}{dt}v(-v)\,dt=\int_{r_{min}}^{r_{max}}v^2\,dm \qquad (16)$$

In a first step, we will use an approximation of this integral, using the approximate value v along the orbit : $v\simeq(2\pi\frac{a}{T})=a\omega_1$ with T orbital period of the planet and ω_1 the corresponding angular velocity. A more accurate calculation will be done in a second step.

$$W_1\simeq(2\pi\frac{a}{T})^2\Delta m=a^2\omega_1{}^2\Delta m \qquad (17)$$

From (5) : $$W_1\simeq a^2\omega_1{}^2 m\frac{\Delta P}{P_0} \qquad (18)$$

On the path Aphelia and Perihelion : $\vec{F}$ and $\vec{v}$ have the same directions but m decreases and thus :

$$W_2=\int_{r_{max}}^{r_{min}}\vec{F}\vec{v}\,dt=\int_{r_{max}}^{r_{min}}\frac{-dm}{dt}v\,v\,dt=\int_{r_{min}}^{r_{max}}v^2\,dm \qquad (19)$$

$$W_2=W_1 \qquad (20)$$

Over a complete orbit, $W \simeq 2a^2 \omega_1^2 m \frac{\Delta P}{P_0}$ (21)

The work of this force is transformed into an additional angular velocity ω_2 along the orbit communicated as additional kinetic energy :

$$W = \frac{1}{2} m a^2 \left((\omega_1 + \omega_2)^2 - \omega_1^2 \right) \simeq m a^2 \omega_1 \omega_2 \tag{22}$$

From (21) and (22) :

$$\frac{\omega_2}{\omega_1} \simeq 2 \frac{\Delta P}{P_0} \tag{23}$$

The additional angular velocity ω_2 is responsible for the drift of the perihelion, and on each new round, the phase shift ϕ verifies :

$$\phi = \frac{\omega_2}{\omega_1} 2\pi \tag{24}$$

But the apparent physical drift of the perihelion is higher than the phase shift according to Kepler 2nd law, the law of areas :

$$\frac{dS}{dt} = \frac{1}{2} r^2 \frac{d\theta}{dt} = Constant\ K = \frac{\pi a b}{T} \tag{25}$$

with dS swept area during the time dt

At the perihelion $r = a(1-e)$ the phase shift corresponds to an advance of Δt and from (25) :

$$\Delta\theta = \frac{ab}{r^2} \left(2\pi \frac{\Delta t}{T} \right) = \frac{ab}{r^2} \phi = \frac{a^2 \sqrt{1-e^2}}{a^2 (1-e)^2} \phi \tag{26}$$

From (12), (23), (24) :

$$\frac{\Delta\theta}{2\pi} = \frac{\sqrt{1-e^2}}{(1-e)^2} \frac{\omega_2}{\omega_1} = \frac{\sqrt{1-e^2}}{(1-e)^2} \frac{8e.GM}{c^2 a (1-e^2)} \tag{27}$$

$$\frac{\Delta\theta}{2\pi} = \frac{8e.GM}{c^2 a \sqrt{1-e^2} (1-e)^2} \tag{28}$$

Let's now come back to determine a more accurate value of the work W_1 .

From (3) and (5) : $dm = \frac{m}{P} \frac{dP}{dr} dr = m \frac{R_s}{r^2} dr$ (29)

with $R_s = \frac{2GM}{c^2}$ R_s is also known as the Schwarzschild radius.

From (16) and (29) : $$W_1 = \int_{r_{min}}^{r_{max}} v^2 m \frac{R_s}{r^2} dr = \int_{r_{min}}^{r_{max}} \left(\frac{r\,d\theta}{dt}\right)^2 m \frac{R_s}{r^2} dr = \int_{r_{min}}^{r_{max}} \left(\frac{d\theta}{dt}\right)^2 m R_s dr \qquad (30)$$

From (25) : $$\frac{d\theta}{dt} = \frac{2K}{r^2} \qquad (31)$$

From (30) and (31) : $$W_1 = \int_{r_{min}}^{r_{max}} 4 \frac{K^2}{r^4} m R_s dr \qquad (32)$$

From (29) : $$m = m_0 \left(1 - \frac{R_s}{r}\right) \qquad (33)$$

But in the case of planet Mercury, $\frac{R_s}{r}$ is lower than 10^{-7} and negligible so $m \simeq m_0$

From (32) and (33) : $$W_1 = 4K^2 R_s m \int_{r_{min}}^{r_{max}} \frac{1}{r^4} dr \qquad (34)$$

$$W_1 = -4mK^2 R_s \left[\frac{1}{3r^3}\right]\Bigg|_{r_{min}}^{r_{max}} = \frac{4mK^2 R_s}{3a^3}\left(\frac{1}{(1-e)^3} - \frac{1}{(1+e)^3}\right) \qquad (35)$$

$$W_1 = \frac{4mK^2 R_s}{3a^3} \frac{2e(3+e^2)}{(1-e^2)^3} \qquad (36)$$

From (25) and (36) : $$W_1 = \frac{8mR_s e(3+e^2)}{3a^3(1-e^2)^3}\left(\pi \frac{ab}{T}\right)^2 \qquad (37)$$

According to Kepler 3rd law : $$\frac{\pi^2}{T^2} = \frac{GM}{4a^3} \qquad (38)$$

Since $b = a\sqrt{1-e^2}$ from (37) and (38) :

$$W_1 = \frac{8mR_s e(3+e^2)}{3a^3(1-e^2)^2} a^4 \left(\frac{\pi}{T}\right)^2 = \frac{8mR_s e(3+e^2)}{3a^3(1-e^2)^2} a^4 \frac{GM}{4a^3} \qquad (39)$$

$$W_1 = \frac{2GMme(3+e^2)}{3a^2(1-e^2)^2} R_s \qquad (40)$$

Since $R_s = \frac{2GM}{c^2}$ from (40) :

$$W_1 = \frac{4em(3+e^2)}{3(1-e^2)^2}\left(\frac{GM}{ac}\right)^2 = \frac{4em}{1-e^2}\left(\frac{GM}{ac}\right)^2 \frac{\left(1+\frac{e^2}{3}\right)}{(1-e^2)} \qquad (41)$$

If we compare this result with the first calculation of W_1 , from (17) (38) (5) (12) :

$$W_1 \simeq (2\pi \frac{a}{T})^2 \Delta m = (\frac{GM}{a^3}) a^2 \Delta m = \frac{GM}{a} m \frac{\Delta P}{P} = \frac{4e.G^2 M^2 m}{c^2 a^2 (1-e^2)} \quad (42)$$

$$W_1 \simeq \frac{4em}{1-e^2} (\frac{GM}{ac})^2 \quad (43)$$

If we compare (41) and (43), we see that they differ by a coefficient k :

$$k = \frac{(1+e^2/3)}{(1-e^2)} \quad (44)$$

Thus, a more accurate formula for the estimation of the perihelion’s drift is obtained by multiplying result obtained in (28) by k :

$$\frac{\Delta\theta}{2\pi} = k.\frac{8e.GM}{c^2 a \sqrt{1-e^2} (1-e)^2} \quad (45)$$

$$\frac{\Delta\theta}{2\pi} = \frac{8e.GM(1+e^2/3)}{c^2 a (1-e^2)^{3/2} (1-e)^2} \quad (46)$$

For n orbits : $$\Delta\theta_{tot} = (\frac{\Delta\theta}{2\pi}) * 2\pi n \quad (47)$$

If we compare (46) with the value obtained from the general relativity (6) the two formulas differ only by their dimensionless term :

General relativity : $\frac{3}{1-e^2}$

Newtonian & ether approach : $\frac{8e.(1+e^2/3)}{(1-e^2)^{3/2}(1-e)^2}$

For circular orbits, the second formula indicates no perihelion’s drift, while general relativity still indicates a drift.

Converted into arcseconds per century, ref [9] indicates measurements between 38” and 43”.
Orbital period of planet Mercury is 87,969 days, and thus planet Mercury performs 415,19 orbits per century.
From (47), General relativity gives a value of 43” while Newtonian/Ether physics gives a value of 38.8”.

Conclusion

Using Newtonian Physics coupled with Ether physics, this paper gives for the perihelion's drift of planet Mercury a value that is in total agreement with the observations, showing that general relativity is not the unique approach that could explain such phenomena.
In addition, the formula obtained with General Relavity shows a non-zero drift for a circular orbit, while this paper would give a null result for a circular orbit.

References

|1] Chris Essonne, *Gravity as the gradient of energy density of the vacuum*, https://www.gsjournal.net/Science-Journals/Research%20Papers/View/8052

[2] Chris Essonne, *Gravity explained with Euler equations applied to a perfect fluid* https://www.gsjournal.net/Science-Journals/Research%20Papers/View/8820

[3] James DeMeo, *The dynamic ether of cosmic space*, ISBN 978-0-9974057-1-2

[4] Chris Essonne, *The Higgs boson and the strong nuclear force explained with the Ether* https://www.gsjournal.net/Science-Journals/Research%20Papers/View/8739

[5] Chris Essonne, *The Ether penetration velocity compared to the Escape velocity* https://www.gsjournal.net/Science-Journals/Research%20Papers/View/9136

[6] Léon Lecornu, *Cours de Mécanique Professé à l'Ecole Polytechnique, Tome II, 1915*

[7] Observatoire de Lyon, *Les lois de Kepler démontrées,* https://cral-perso.univ-lyon1.fr/labo/fc/cdroms/cdrom2014/gravitation/genese/140324-kepler_demontre.pdf

[8] Chris Essonne, *The drift of Mercury's perihelion explained with Ether physic* https://www.gsjournal.net/Science-Journals/Research%20Papers/View/9301

[9] https://en.wikipedia.org/wiki/Tests_of_general_relativity