Hulse-Taylor Pulsar Periastron Precession is due to Magnetic Attraction propagating at light-speed by Electromagnetic Waves

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Abstract In [Dan], we showed how Einstein derived his General Relativity under the erroneous assumption that Retarded Gravitational Potentials, and Retarded Electromagnetic Potentials are similar, and concluded erroneously that Gravitational Radiation propagates at light speed. That is, Gravitational Radiation is electromagnetic.

In the case of the Hulse-Taylor Pulsar, the magnetic attraction dominates the gravitational, the radiation is electromagnetic, and the General Relativity formula gives the pulsar's orbit precession.

However, there are pulsars where the Magnetic attraction does not dominate the gravitational attraction, and the General Relativity Formula fails.

Keywords Gravitation, Hulse-Taylor Pulsar, Periastron Precession, Magnetic Field, Magnetic Moment, Electromagnetic Radiation, General Relativity Tests, Gravitational Waves, Binary Star, Magnetar, Supernova, Magnetic Dipole, Star, Magnetosphere, Neutron Stars,

Physics & Astronomy Classification Scheme: 04; 97.60.Gb; 97.60.Bw; 97.60.Jd; 95.30.Sf; 97.10.Ld; 97.80.-d;

Contents

Magnetic Attraction and Gravitation

Before Newton's Gravitation Law, Kepler suggested Magnetic Attraction as the cause of Gravitation.

While the earth and the Sun have Magnetic Fields, probes have established that the Moon, Venus, and Mars do not.

And the measured fields are weak:

The Earth's surface Field is about $3 \cdot 10^{-1}\text{Gauss}$, and the Sun's is about 1Gauss.

Mercury was found by Mariner 10 (1974-75) to have a field with dipole moment of $2 - 5 \cdot 10^{19}\text{Amp} \times \text{met}^2$, and surface values of $3 \cdot 10^{-3}\text{Gauss}$.

Thus, it was established that Gravitational force differs from Magnetic Force.

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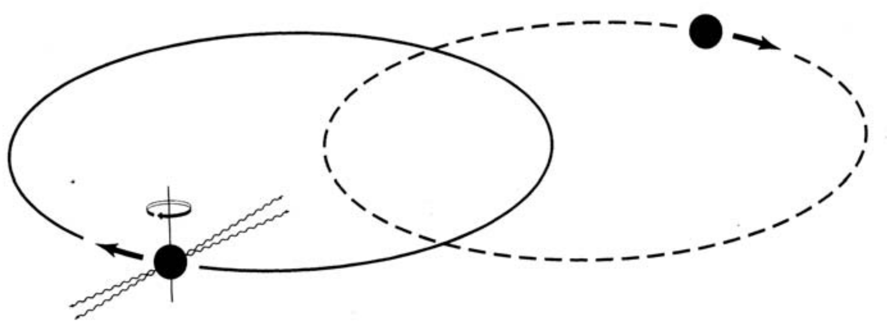
1.

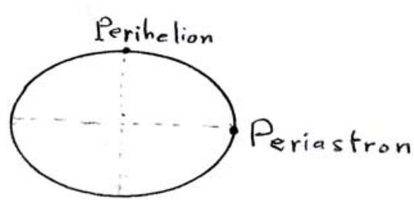
The Precession of the Periastron of the Hulse-Taylor Pulsar

In a 1974 Search for Pulsars, Hulse and Taylor discovered a Pulsating Neutron Star that had a companion, apparently, another Neutron star, with similar mass, and orbit.

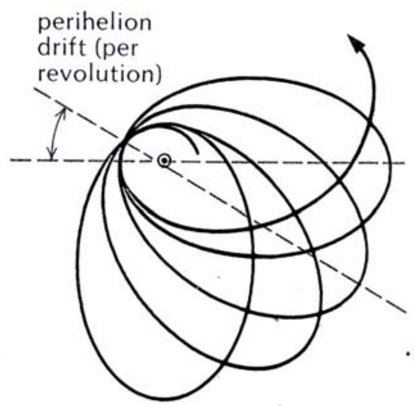
A sketch of the pulsar and its companion orbiting each other from Hulse Nobel lecture is



The Periastron on the pulsar orbit is on its major axis



The Pulsar's elliptic orbit rotates in the direction of its motion,



Then, the Perihelion, and the Periastron precess about the companion. In the case of Mercury, we refer to the precession of its Perihelion.

In the case of the Hulse–Taylor pulsar, the similar size of the orbits of the pulsar and its companion, makes it easier to refer to the precession of the Pulsar's Periastron.

Presumably, Mercury Perihelion has unexplained precession of 43" per hundred years. That was claimed by Einstein to confirm General Relativity.

Einstein proposed that the presumed Mercury's unexplained precession in radians per revolution is

$$24\pi^3 \frac{a^2}{T^2c^2(1-e^2)},$$

where

$a =$ half the major axis of the ellipse (in centimeters)

$e =$ eccentricity

$c =$ light speed in the vacuum (in centimeters)

$T =$ period of a revolution (in seconds)

In [Dan] we showed that Einstein's formula is based on the erroneous guess that retarded gravitational and electromagnetic potentials are identical.

Furthermore, the $43''$ value is highly speculative.

By the Wikipedia's "Tests of General Relativity", the observed perihelion precession of Mercury is $574''$.

By unspecified arguments, Gravitational pull of other planets accounts for $531''$, and $43''$ is unaccounted for.

Since the certainty of these claims is unknown, we have to consider them in terms of statistical confidence.

Note that 97% confidence in $531''$, allows for 3% error in $531''$ which is $15.93''$. But that means a 37% error in $43''$ which allows only 63% confidence in the $43''$.

Note that 95% confidence in $531''$ allows for $26.55''$ error, and only 38% confidence in the $43''$.

By confirming the $43''$ with erroneous κ, Einstein's General Relativity establishes with 100% confidence that the unaccounted-for, perihelion-precession of Mercury is not $43''$.

However, the Hulse-Taylor Pulsar orbits its companion in $7^{h}45^{min}$, and the advance of its Periastron at a rate of about 4° per year, is believed to be due only to the effect of the companion.

Then, Hulse and Taylor found that the General Relativity formula is confirmed.

That means that the radiation propagates at light speed, in which case the waves must be electromagnetic,

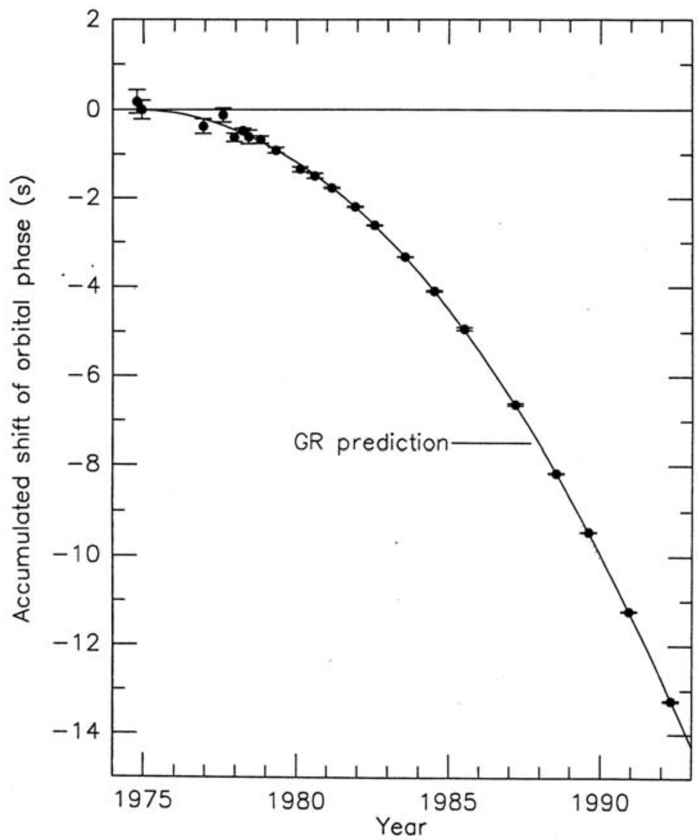
Indeed, the General Relativity formula would have been correct had the attraction been electromagnetic.

We will see that the General Relativity formula for precession applies to the Hulse-Taylor Pulsar because of the enormous Magnetic fields of the Neutron stars.

The Magnetic attraction between the Hulse-Taylor Pulsar and its companion dominates the gravitational attraction. The carrier of the magnetic field are photons, that is electromagnetic waves that propagate at light speed.

Thus, the General Relativity Formula describes the Periastron Precession of Neutron Stars Binary systems, whenever the Magnetic attraction dominates, and masks the Gravitational attraction.

The fit over recent years is given in Taylor's Nobel lecture, by the following graph



Such 0.4% error fit does not apply to all pulsars. In the case of PSR 1534+12, Taylor reported that the fit has 20% error. Apparently, the Magnetic attraction does not dominate, and mask the Gravitational, and the General Relativity formula fails.

2.

The Magnetic Fields of Pulsars, and Magnetars

It is believed that in a Supernova, a star with mass greater than 1.44 solar masses, collapses under its gravity, its atoms crash, its electrons and protons transform into neutrons densely, and tightly packed in 10-12 kilometers ball.

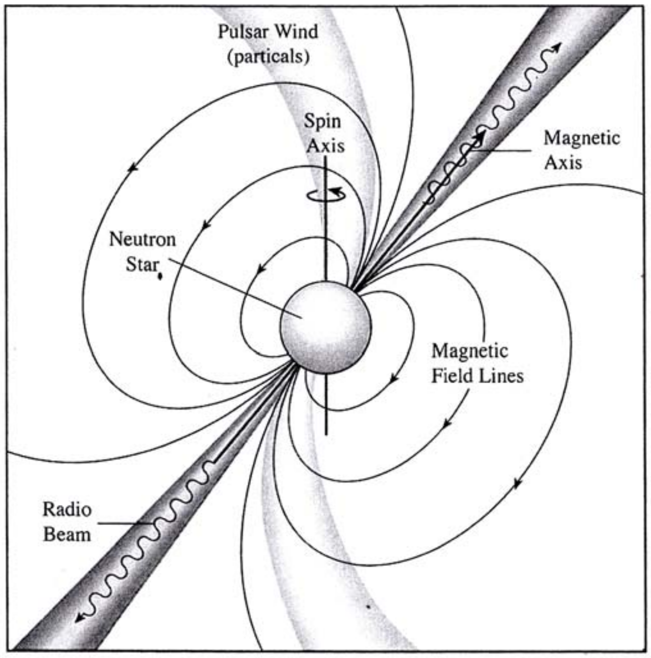
Its density is estimated to vary from 10^9 $\mathrm{kg/m^3}$ in its crust, to 8×10^{17} $\mathrm{kg/m^3}$ in its interior, exceeding the nuclear density of 3×10^{17} $\mathrm{kg/m^3}$.

Since the Neutron star surface is very close to its mass center, the Star's surface gravity may be 10^{11} times that of the earth. But the Gravitational Field, computed with the mass considered as a point at its origin, remains the same.

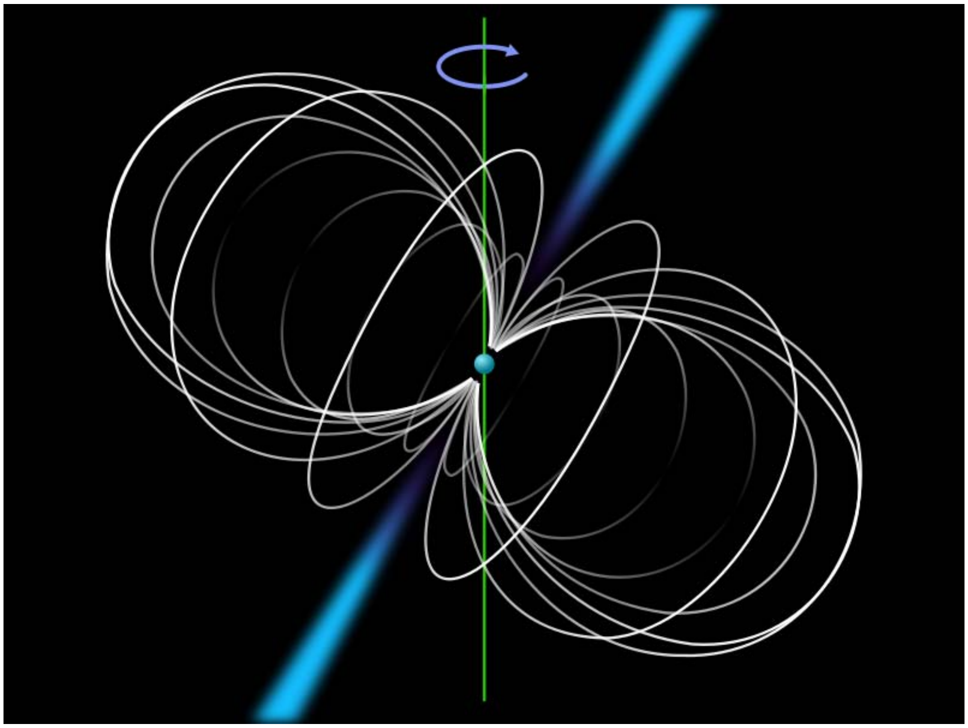
The Angular Momentum of the slowly spinning collapsing star, conserved in the Neutron star with its smaller radius, may lead to hundreds of revolutions per second. Neutron Stars spin about their axis in 1mili-sec to $10\,\text{sec}$.

The rotation of electrical charges creates enormous Magnetic Fields, and turns the Neutron Star into a huge Magnetic dipole.

The Magnetic Dipole Moment is believed to be oriented at an angle to the rotation axis.



The spinning Magnet generates electric currents that radiate electromagnetic waves along the magnetic axis.
The radiation beam sweeps the sky like a light house, and an observatory swept by the beam, will record pulses of electromagnetic radiation.
A 3D picture, [Wikipedia, Pulsar]



These schematics, are confirmed by Optical, and X-rays images obtained in satellite observatories:

The best known Pulsar is at the center of the Crab Nebula, a supernova remnant with diameter of 10 light years, at a distance of 6300 light years from earth, expanding at 1800 km/sec. Its Pulses are in the optical, X-rays, and gamma-ray parts of the electromagnetic spectrum

In addition to the radiation along the magnetic Axis, Synchrotron Radiation of Radio waves, optical waves, and gamma rays in the surrounding pulsar wind nebula, is generated by electrons with energies up to 10^8MeV spiraling around the pulsar's magnetic fields force lines.

The electrons are pulled from the pulsar's surface by the induced Electric field against the pulsar's huge gravitation.

Early observations detected Magnetic Fields with strengths about $10^{12}\text{Gauss} = 10^{8}\text{Tesla}$. But by 2010 data, [Leblanc], a typical Pulsar's Magnetic Field strength is about

$$10^{14}\text{Gauss} = 10^{10}\text{Tesla},$$

where $\text{Tesla} = \dfrac{\text{Weber}}{\text{m}^2} = \dfrac{\text{kg}}{\text{sec}^2\text{Amp}}$.

The Sun's Magnetic Field is about 1 Gauss.

Magnetars, Pulsars with fields that are

$$10^{14}\text{-}10^{15}\text{Gauss} = 10^{10}\text{-}10^{11}\text{Tesla}$$

are the source of gamma-ray bursts.

The Magnetar SGR 1806-20 Field is $10^{15}\text{Gauss}=10^{11}\text{Tesla}$.

Our references state that such Magnetic fields can distort the electron shells of atoms of a living cell, and kill the cell from a distance of 1000km.

3.

The Magnetic Attraction in the Hulse-Taylor Binary Pulsar Dominates the Gravitational

The General Relativity Precession formula does not apply to retarded Gravitational Potentials, and to gravitational radiation, because they are not electromagnetic.

But Neutron stars are magnetic dipoles, and the Precession formula may apply to them, provided that the Magnetic Fields dominate the attraction.

If the Neutron star has a companion Neutron Star, as is the case of the Hulse-Taylor Pulsar the Magnetic attraction may dominate the Gravitational, and Electromagnetic waves are the carrier of the Magnetic Attraction.

Then, the General Relativity formula for the precession of the Periastron of the Neutron star may apply, because it was derived for retarded electromagnetic potentials, carried by electromagnetic waves.

4.

The Precession of the Periastron of PSR 1534+12

The Magnetic field of PSR 1534+12 does not dominate its Gravitational Field, and the radiation is not all electromagnetic.

By [Hulse-Taylor, p.87],

"PSR 1534+12…has

orbital period $P_b \approx 10.1\text{hour}$*,*

eccentricity $e \approx 0.27$*,*

…Its times of arrivals have…uncertainties around $3\mu\sec$ *for five-minute observations*

The orbital decay rate $\dot{P}_b$ ***is in accord with general relativity at about the*** 20% ***level"***

References

[Bartusiak], Marcia Bartusiak, "*Archives of the Universe, A treasury of Astronomy's Historic Works of Discovery*"

[Cohen] E. Richard Cohen, "*The Physics Quick Reference Guide*", American Institute of Physics, 1996.

[Dan] H. Vic Dannon, "*Gravitational Waves Do Not Propagate at Light Speed, And Mercury's Perihelion Precession Does Not confirm General Relativity*" Gauge Institute Journal of math and Physics, Volume 10, No. 2, May 2014, Also posted to www.gauge-institute.org

[Einstein1], A. Einstein, "*The Foundation of the General Theory of Relativity*" in "*The Principle of Relativity*", Dover 1952.

[Einstein2], A. Einstein, "*Approximative Integration of the Field Equations of Gravitation*" Document 32 in "*The Collected Papers of Albert Einstein*", Volume 6, The Berlin Years Writings, 1914-1917.

[Einstein3], Albert Einstein, "*The Meaning of Relativity*" Fifth Edition, MJF Books, 1984.

[Gaensler] Bryan Gaensler, "*Extreme Cosmos, A Guided Tour to the Fastest Brightest, Hottest, Heaviest, Oldest, and Most amazing aspects of our Universe*" Perigee, 2011.

[Hulse-Taylor] Russell A. Hulse, "*The Discovery of the Binary*

Pulsar", Nobel Lecture December 8, 1993, and Joseph H. Taylor, "*Binary Pulsars and Relativistic Gravity*", Nobel Lecture December 8, 1993, in "*Nobel Lectures Physics*", 1991-1995, World Scientific, 1997.

[Kaler], James Kaler, "*Extreme Stars At the edge of Creation*", Cambridge, 2001.

[Lang], Kenneth R. Lang, "*Parting the Cosmic Veil*", Springer, 2006.

[Leblanc], Francis Leblanc, "*An Introduction to Stellar Astrophysics*", Wiley, 2010.

[Panofsky], Wolfgang Panofsky, and Melba Philips, "*Classical Electricity and Magnetism*", second edition, Addison Wesley, 1962.

[Rose], William K. Rose, "*Advanced Stellar Astrophysics*", Chapter 10, "Stellar Magnetic Fields", pp. 302-322, Cambridge, 1998.

[Rudiger-Hollerbach], G. Rudigger and R. Hollerbach "*The Magnetic Universe, Geophysical and Astrophysical Dynamo Theory*", Chapter 7, "Neutron Star Magnetism", pp.265-279, Wiley-VCH, 2004.

[Shapiro-Teukolsky], Stuart L. Shapiro; Saul A. Teukolsky, "*Black Holes, White Dwarfs, and Neutron Stars*" Wiley, 1983.

[Zirker], J.B. Zirker, "*The Magnetic Universe, The Elusive*

Traces of an Invisible Force", Johns Hopkins, 2009.

http://en.wikipedia.org/wiki/Star

http://en.wikipedia.org/wiki/Supernova

http://en.wikipedia.org/wiki/Chandrasekhar_limit

http://en.wikipedia.org/wiki/Pulsar

http://en.wikipedia.org/wiki/Binary_star

http://en.wikipedia.org/wiki/Magnetar

http://en.wikipedia.org/wiki/Magnetic_field

http://en.wikipedia.org/wiki/Magnetic_moment

http://en.wikipedia.org/wiki/Magnetic_dipole%E2%80%93dipole_interaction

http://en.wikipedia.org/wiki/Magnetosphere

http://en.wikipedia.org/wiki/Tests_of_general_relativity

http://en.wikipedia.org/wiki/Gravitational_wave