Stellar Metamorphosis: Stellar Axial Angular Momentum During Evolution

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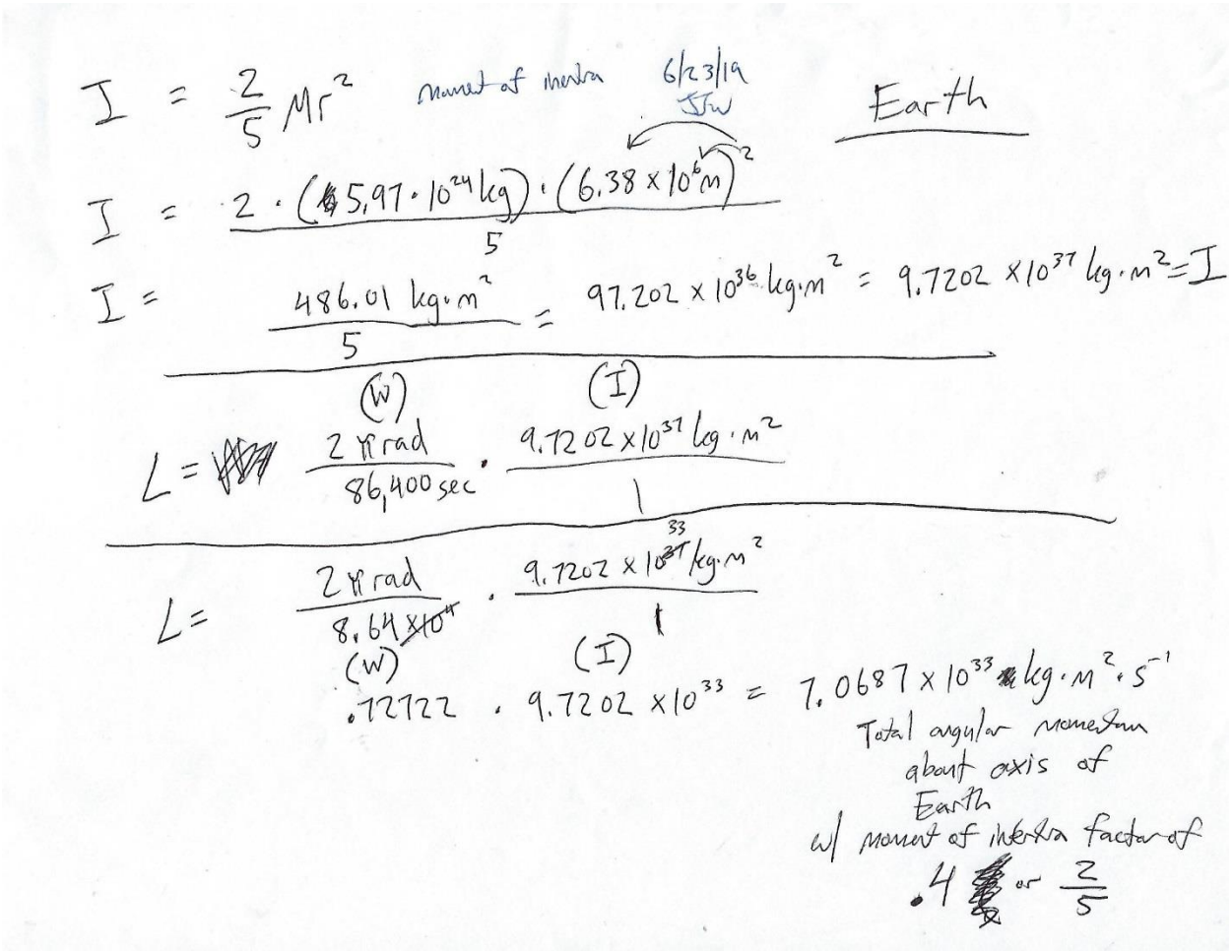
Abstract: A new branch to the general theory is described. The star's total axial angular momentum decreases as it evolves. Angular momentum is mathematically described as L = I*W. L is angular momentum, I is the moment of inertia, W is the angular velocity. As well, for future reference the moment of inertia factor will change for the Sun as it is a homogeneous body. Its moment of inertia factor is probably very close to .4, not .070 as purported by the dogma. The math is shown for I= 2/5Mr^2, and W = 2Pi rad/86,400 seconds, for the Earth. Plus a few additional notes are added to compare Mars to Venus to Earth.



As stars evolve their total axial angular momentum diminishes. This is because their moment of inertia factor changes, their masses change, the rates at which they lose/gain mass changes, their total angular velocities change as well as their total diameter changes (which directly impacts both their densities and moment of inertia).

What this means is that only young stars can have lots of comparable angular momentum about their centerlines, and it means we can give another pillar to astrophysics with the determination of stellar ages. This pillar directly involves the star's angular momentum, which is a subset of gyrochronology as a whole. It not only includes both the angular (tangential) velocity, and its rotational velocity, but the role mass loss has during stellar evolution. Mass can be lost at greater amounts per unit mass during specific stages as well, so they are variable mass systems, similar to rocket exhaust, but the mass loss is dependent on many more variables and vectors.

So it is abundantly clear, the Sun is a young star because it has a very large angular momentum. It is easy to reason. Think of a top that spins on the ground. Do you think the most angular momentum is in the top after 10 seconds or just after you spin it? The same goes with stars. They slow down. Jupiter and Saturn are middle aged stars because their axial angular momentum is much lower. Uranus and Neptune are even older, because their axial angular momentum is even lower. The Earth is even older, because of its axial angular momentum being even lower. Comparing Mars to Mercury or Venus will be possible as well. Mars' angular momentum should be higher than Venus, regardless if it is less massive. This is truly extraordinary!

Mars

6/27/19

$I = \frac{2}{5} M r^2$

$I = \frac{2 \cdot (6.39 \times 10^{23}\ kg) \cdot (3.3895 \times 10^{6}\ m)^2}{5}$

(Mass of Mars; radius of Mars)

$I = \frac{146.83\ kg \cdot m^2 \times 10^{35}\ kg \cdot m^2}{5}$

$I = 29.366\ kg \cdot m^2 \times 10^{35}$

Earth $= 7.0687 \times 10^{33}\ kg \cdot m^2 \cdot s^{-1}$

Mars $= 2.082 \times 10^{32}\ kg \cdot m^2 \cdot s^{-1}$

$\omega = \frac{2\pi\ rad}{88{,}620} \cdot \frac{2.9366 \times 10^{36}\ kg \cdot m^2}{1}$

Earth has ~33 times the total axial angular momentum as Mars!

$\omega = \frac{2\pi\ rad}{8.862 \times 10^{4}} \cdot \frac{2.9366 \times 10^{32}\ kg \cdot m^2}{1}$

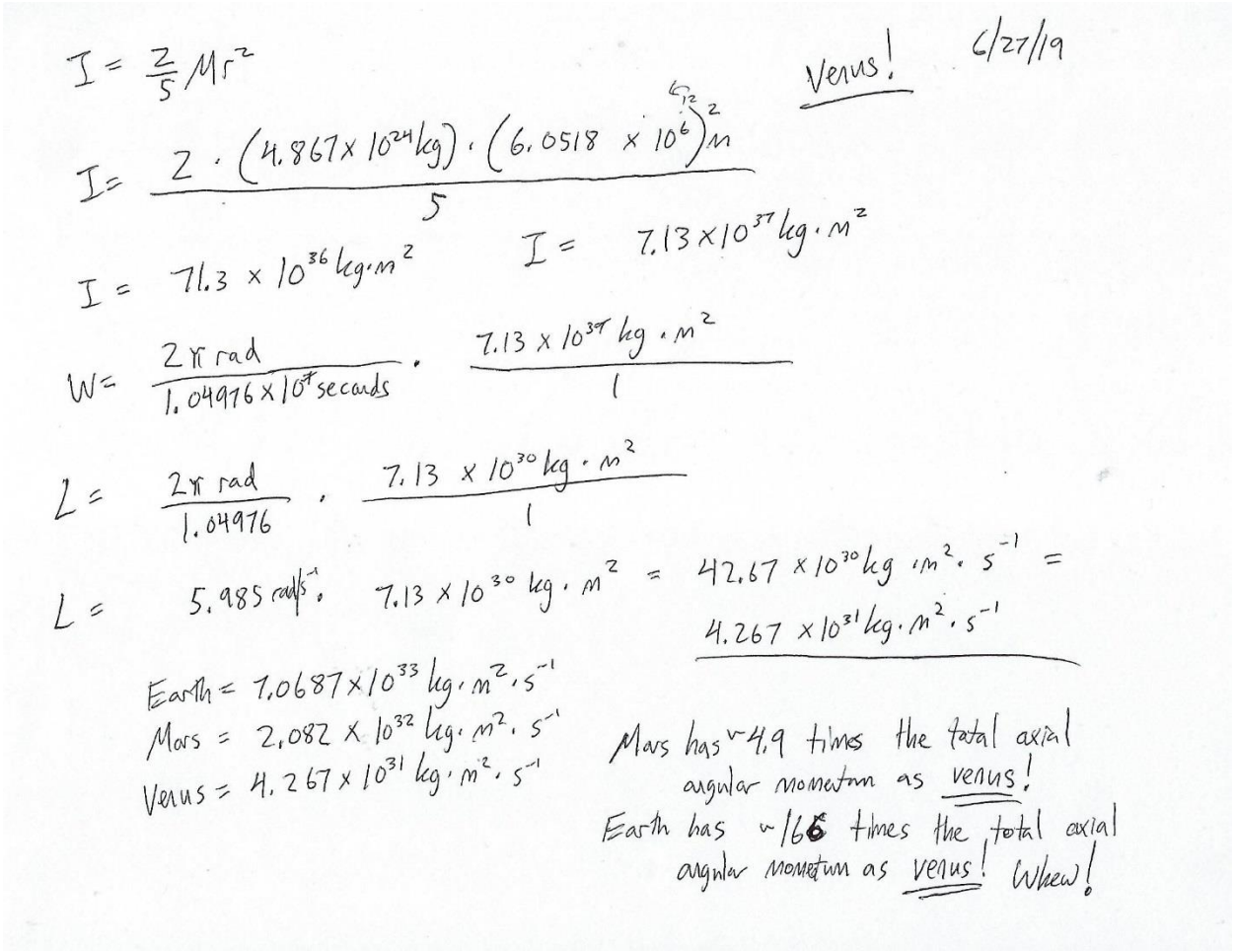
$L = 7.09^{s^{-1}} \cdot 2.9366 \times 10^{32}\ kg \cdot m^2 = 20.82 \times 10^{32}\ kg \cdot m^2 \cdot s^{-1} =$

~~$2.082 \times 10^{33}\ kg \cdot m^2 \cdot s^{-1}$~~

forgot!

Total angular momentum about axis assuming moment of inertia of 2/5

$2.082 \times 10^{32}\ kg \cdot m^2 \cdot s^{-1}$



We now know the truth. Given there is almost no friction with outer space, the axial spin energies of Earth and Venus are about 166 times greater than the other. This means Venus is extremely old, as it has had enough time to spin down (hundreds of billions of years), it is an unfathomably old, celestial spinning top. If it was born from the same processes, with almost similar mass as the Earth, why is it spinning with 166 times less momentum as the Earth? It is because it is easily >100-150 times older than the Earth. This fact is also supported by its measured D/H ratios compared to Earth. As well, Mars even has more angular momentum than Venus! How could an object ~13 times less massive than Venus have ~4.9 times the axial angular momentum? It is because Mars is much younger than Venus and has not had enough time to spin down, as well, it was on a completely different transformation curve, so different mass loss variables played a part.

This paper is just the beginning of the new stellar gyrochronology. More calculations are on the next few pages, with changes in the moment of inertia factor.

Neptune! 6/29/19

FJN

$I = .23\, Mr^2$

$I = .23\left(1.024 \times 10^{26}\, kg\right) \cdot \left(24{,}622 \times 10^{6}\right)^2 m$

606,24

$I = 142.78 \times 10^{38}\, kg \cdot m^2$

$I = 1.4278 \times 10^{40}\, kg \cdot m^2$

$W = \frac{2\pi\, rad}{16(60)(60) + 6(60) + 14} = \frac{\cancel{18.85\ rad}}{57{,}600 + 360 + 14} = \frac{\cancel{18.85}\ 6.28\ rad}{57974} = \frac{6.28\ rad}{5.7974 \times 10^{4}} =$

$1.4278 \times 10^{36}\, kg \cdot m^2 \times 1.0832\ rad \cdot sec^{-1} = 1.5466 \times 10^{36}\, kg \cdot m^2 \cdot s^{-1}$

Uranus! 6/29/19

$I = \left(\frac{2}{5}\right) M r^2$ moment of inertia factor set to .23 instead not .4

$I = .23\left(8.681 \times 10^{25}\ kg\right) \cdot \left(25.362 \times 10^{6}\right)^2 m$

$I = 1{,}284.29 \times 10^{37}\ kg \cdot m^2$

$I = 1.28429 \times 10^{40}\ kg \cdot m^2$

$W = \frac{2\pi\ rad}{17(60)(60) + 14(60)} = \frac{2\pi\ rad}{61{,}200 + 840\ s} = \frac{6.28\ rad}{62040\ s} = \frac{6.28\ rad}{6.204 \times 10^{4}\ s} = 1.0122\ rad \cdot s^{-1}$

$L = 1.0122\ rad \cdot s^{-1} \cdot 1.28429 \times 10^{36}\ kg \cdot m^2 = \underline{1.3 \times 10^{36}\ kg \cdot m^2 \cdot s^{-1}}$

Sun! L = total angular momentum

6/29/19

$I = .4(1.989 \times 10^{30}\,kg) \cdot (695.51 \times 10^{6})^2\,m$

$I = 384,859 \times 10^{42}\,kg \cdot m^2 = 3.84859 \times 10^{47}\,kg \cdot m^2$

$W = \frac{6.28\,rad}{(31)days\,(24)(60)(60)} = \frac{6.28}{2.6784 \times 10^{6}} =$

$L = 3.84859 \times 10^{41}\,kg \cdot m^2 \cdot 2.345\,rad/s =$

$L = 9.0237 \times 10^{41}\,kg \cdot m^2 \cdot s^{-1}$

Hypothetical white dwarf Angular momentum

$L = 5.25 \times 10^{40}\,kg \cdot m^2 \cdot s^{-1}$

1. Sun's angular momentum > Hypothetical white dwarf angular momentum
2. Since white dwarf is younger, it is still accreting mass
3. As well, it could mean the sun's ~~total~~ angular velocity internally is actually lower, meaning its surface gives the appearance of whole body rotation

4. This would explain why it is so perfectly round, and not bulging ~~on the~~ at the equator as does bodies which have whole body rotation
5. As well, the moment of inertia factor can be adjusted

Hypothetical white dwarf!

$I = .4\,(1 \times 10^{30}\,kg) \cdot (6.371 \times 10^{6})^2$

(1 solar mass = 2 × ½ solar mass; Earth's radius)

$I = 16.23 \times 10^{42}\,kg \cdot m^2$

$I = 1.623 \times 10^{43}\,kg \cdot m^2$

Rotation = 1,943 seconds

$\frac{2\pi rad}{1943} = \frac{6.28}{1.943 \times 10^{3}} = 3.234\ rad/s \cdot 1.623 \times 10^{40}\,kg \cdot m^2$

$L = 5.25 \times 10^{40}\,kg \cdot m^2 \cdot s^{-1}$

Jupiter! 6/29/19 -JJW

$I = .2756\left(1.89813 \times 10^{27}\,kg\right) \cdot \left(69.911 \times 10^{6}\right)^{2} m$

$I = 2{,}556.8 \times 10^{39}\,kg \cdot m^{2}$

$I = 2.5568 \times 10^{42}\,kg \cdot m^{2}$

$w = \frac{6.28\,rad}{9(60)(60) + 56(60)} = \frac{6.28\,rad}{32{,}400 + 3360\,sec} = \frac{6.28\,rad}{3.576 \times 10^{4}}$

$L = \frac{6.28\,rad}{3.576\,sec} \cdot 2.5568 \times 10^{38}\,kg \cdot m^{2} = 4.49 \times 10^{38}\,kg \cdot m^{2} \cdot s^{-1}$

Saturn! 6/29/19 moment of inertia factor .22

$I = .22\, M_S r^2$

$I = .22\left(5.683 \times 10^{26}\,kg\right) \cdot \left(\frac{58,232 \times 10^6}{3,390}\right)^2 m$

$I = 4,238.38 \times 10^{38}\,kg \cdot m^2$

$I = 4.23838 \times 10^{41}\,kg \cdot m^2$

$W = \frac{6.28\ rad}{10(60)(60) + 42(60)\,sec} = \frac{6.28\ rad}{36,000 + 2520\ sec} = \frac{6.28}{38,520\ sec} = \frac{6.28\ rad}{3.8520 \times 10^4\ sec}$

$L = 4.23838 \times 10^{37}\,kg \cdot m^2 \cdot \frac{6.28\ rad \cdot s^{-1}}{3,852}$

$L = \cancel{6.91\ kg \cdot m^2 \cdot s^{-1}}\ \ 6.91 \times 10^{37}\,kg \cdot m^2 \cdot s^{-1}$

6/29/19
JTM

Axial Angular Momentums made dimensionless to ease writing

4.267 ~~Venus~~ Venus

~~2.0~~

20.82 Mars

706 Earth

154,660 Neptune

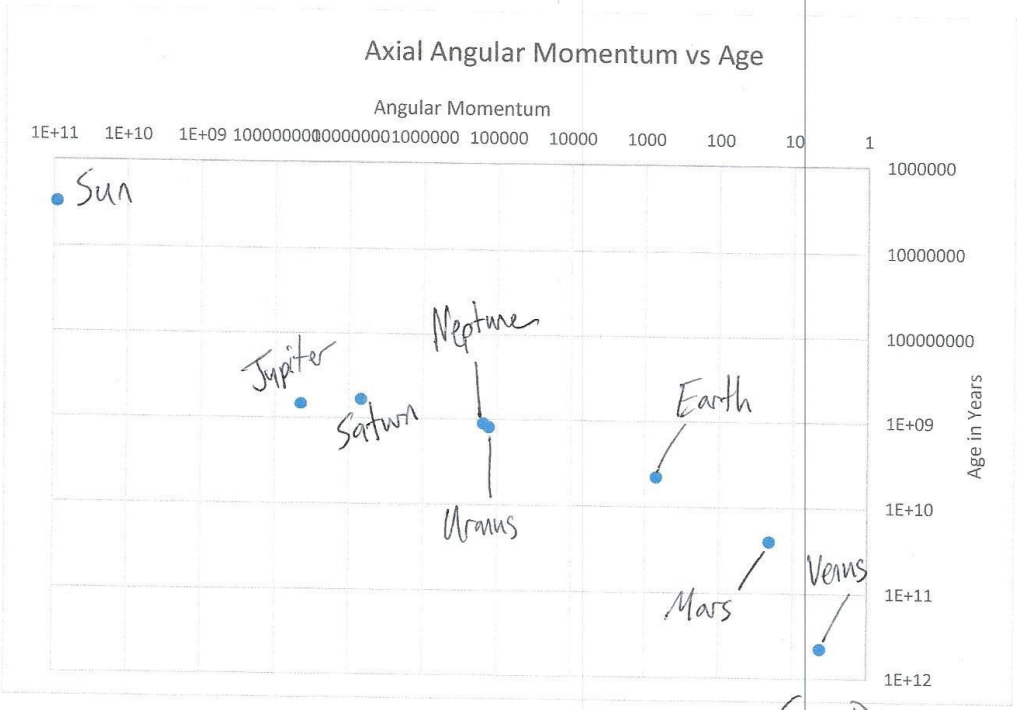
130,000 Uranus

6,910,000 Saturn

44,900,000 Jupiter

9,023,000,000 Sun

6/29/19



As the reader can see, the angular (axial) momentums of the bodies diminishes with age by multiple magnitudes. Both angular momentum and ages are plotted on Log_{10} scales, so that the data is easy to read on one graph. Their axial angular momentums are extremely different, as well as their ages. We live in a star system that has stars in it that are so evolved that astronomers call them "planets". We have a very different universe than what astronomers claim! Venus, Mars and Earth are extremely evolved stars! Neptune and Uranus are right behind them!