COMMENTS on

The Cause of Gravity

Gary D. Gordon March 15, 1994

These are a few comments on a paper by Ali F. AbuTaha. This theory states that bodies and particles attract, or repel, each other in proportion to the fourth-power of their Internally Screened-Temperatures, and in proportion to the inverse square distance between their centers.

The subject of this paper is fascinating. I find different individuals are satisfied by different answers. The question "Why do objects fall?" can be answered in so many different ways. A child may be told "you didn't hold on to it." Many are satisfied with equations that predict the motion, such as $s = \frac{1}{2}gt^2$, or with Kepler's Laws. Newton provided more insight with his universal law of gravitation, and Einstein with general relativity. Einstein spent 25 years looking for the unified field theory, without success. Recently many experiments have been looking for gravitational radiation. Some of these advances provide new insight, but none satisfies completely.

The paper compares the two equations:

$$g = AT^4/R^2 \qquad \text{and} \qquad g = GM/R^2$$

The first is the new theory, the second is based on Newton's law of universal gravitation. Numerical studies of the solar system provide an accurate value for the constant GM in the second equation. There is no astronomical method of measuring the mass independently of G. Measurement of G by the Cavendish experiment lead to reasonable values for the density of the earth. [My edition of the Encyclopædia Britannica says that Cavendish did his experiment to determine the destiny (sic) of the earth!]

As long as the constant (GM or AT^4) remains a constant, it is hard to prove one is right and the other is wrong. We can assume, as the paper does, that T = 10,000 K, calculate a corresponding value of A, and use AT^4 instead of GM. A test of the theory's usefulness is when the temperature changes. So I concentrated on looking for gravitational effects when the temperature changes.

We can assume that all the masses in the Cavendish experiment are at the same temperature, that is, room temperature. A change of $\Delta T = 7°C$ should lead to a change of 10% in the force of attraction. Many of these experiments were done when room heating was primitive, and air conditioning non-existent. It is difficult to imagine that such a temperature dependence would not be detected, since students probably get 1% accuracy, and accuracies of 0.01% can be achieved.

Meteor showers are made up of many small particles in very elongated orbits. Their temperature is probably based on an equilibrium between the sun's radiation and the heat emitted. The fourth power of the temperature, T^4, would then be proportional to the solar constant, that is, inversely proportional to the square of the distance. Then we would have

$$g = AT^4/R^2 = k/R^4$$

If the numerator includes the temperature of both the sun and the meteor ($T_{sun}^4 + T_{meteor}^4$), there should still be an effect when the meteor comes close to the sun. At the closest approach their temperatures are still less than the sun's, but would reach a few hundred degrees K. Goldstein in **Classical Mechanics** (p. 91) shows that if the force drops off faster than the inverse square law it leads to a precession of the perihelion.

Comets are in similar elongated orbits. Here we would expect some thermal inertia. I have not made any calculations, but this could be done. At a chosen distance from the sun, they would be cooler on the inward flight than on the outward flight. The theory of acceleration based on temperature leads to a non-conservative force field. On the outward flight they would lose more kinetic energy than they pick up on the inward flight. The comets would lose total energy, and their semi-major axis and period would decrease. This should show up as comet periods decreasing with time.

I understand you are looking for objections that people might raise in reviewing your theory. I hope the above is helpful. I am also attaching a calculation of the analemma.

Calculation of the Analemma

Gary D. Gordon March 15, 1994

There may be many ways of calculating the analemma. The procedure uses well known equations, but is not simple. Here the position of the sub-solar point on the ground is calculated for noon (GMT) every ten days throughout 1993. [If you wanted to travel around on land and observe the sub-solar point, you should probably pick 10:00 AM, and travel around Africa.] The calculations shown here are based on my book[1]. While the analemma is not explained, nor mentioned, it does provide the equations for determining the direction of the sun.

The time, determined as a Julian Date, is

$$d = -2557, -2547, -2537, \ldots$$

where the first date is noon on January 0 (or Dec 31, 92), the next is noon on January 10, etc.

The sun's mean longitude and the earth's mean anomaly are

$$L_{mean} = 280.460° + 0.9856474° \, d$$

$$M_E = 357.528° + 0.9856003° \, d \qquad (6.30)$$

Both of these increase uniformly at the rate of 360°/365.24 days. The slight difference is because the angle between the vernal equinox and the perihelion has a secular change. The first constant 280.460° is the angle to the sun from the vernal equinox at the beginning of the year. This constant says that the beginning of the year occurs about ten days after winter solstice (270°). The second constant 357.528° is the angle to the sun from perihelion. This constant says that perihelion occurs a few days after the beginning of the year. All these angles are measured along the ecliptic.

The actual sun's longitude, measured along the ecliptic is calculated as

$$L_{sun} = L_{mean} + 1.915° \sin M_E + 0.020° \sin 2\, M_E \qquad (6.30)$$

This is where the **eccentricity** of the earth's is used. The first coefficient is $2e\,(180°/\pi)$, and the second is $(5/4)\, e^2\, (180°/\pi)$.

The last equation includes an approximation for the solution of Kepler's equation. If you want to check how accurate the approximation is, the exact equations are shown below. The true

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[1] W. L. Morgan and G. D. Gordon, **Handbook of Communications Satellite**, Wiley, 1989, pp. 799-809.

anomaly v, the tangent of the eccentric anomaly tan E, and the mean anomaly M_E, are

$$v = M_E + L_{sun} - L_{mean}$$

$$\tan E = [(1 - e^2)^{1/2} \sin v]/(\cos v + e) \qquad (6.39)$$

$$M_E = E - e \sin E \qquad (6.43)$$

and if M_E doesn't come out right, then L_{sun} has to be adjusted until it does. The last equation above is the famous Kepler's equation, which has to be solved numerically, or approximated by other equations (such as a series).

The above all refers to motion in the orbit plane (ecliptic). This is where the **obliquity** of the ecliptic comes in. This is the angle between the ecliptic and the equatorial plane ($\epsilon = 23.439°$). The calculation of right ascension and declination are just the solution of a spherical triangle. The right ascension is

$$\tan \alpha = \cos \epsilon \sin L_{sun} / \cos L_{sun} \qquad (6.32a)$$

To get the right quadrant, use the ATAN2 function, and keep the numerator (y) and denominator (x) separate. Note that Fortran uses ATAN2(y,x) and Lotus uses @ATAN2(x,y), which is confusing.

The declination is

$$\tan \delta = \tan \epsilon \sin \alpha \qquad (6.32b)$$

which is always between -90° and 90°, so the ATAN function can be used. The declination of the sun is equal to the latitude of the sub-solar point.

To calculate the longitude, the relation between right ascension and longitude is given by the Greenwich Hour angle:

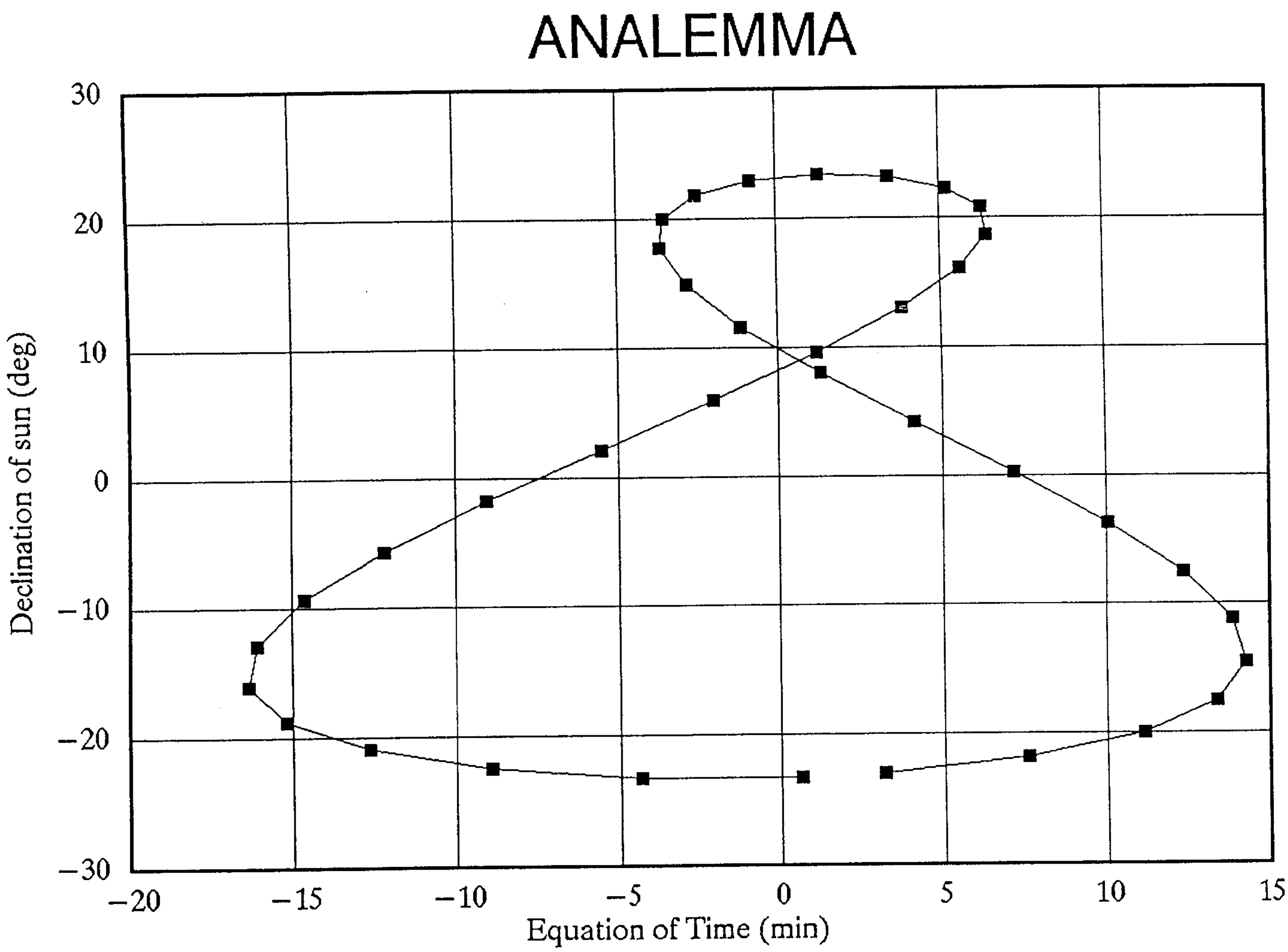
$$GHA = 100.4602346° + 0.985647348\ (d - 1200/2400) + 15.041068*12 \qquad (6.58)$$

The longitude is then

$$\lambda = \alpha - GHA \qquad (6.59)$$

Most of the calculations were done in degrees. To plot the longitude in minutes, instead of degrees, multiply by four.

The calculations were done with Lotus 3.1. The equations are more complicated than Speakeasy because of the @ sign required, variables are in degrees and calculations in radians, and methods used to get the angles in the right range.


ANALEMMA
30
20
10
0
−10
−20
−30
Declination of sun (deg)
−20
−15
−10
−5
0
5
10
15
Equation of Time (min)

a	b	c	d	e	f	g	h
		ANALEMMA				GDGordon	
d	L mean	M	L sun	alph	decl	GHA	4*long
-2557	280.1596	357.348	280.0691	-79.0463	-23.0569	280.16	3.174973
-2547	290.0161	7.204036	290.2612	-68.0831	-21.9106	290.0164	7.602059
-2537	299.8725	17.06004	300.4456	-57.3552	-20.0551	299.8729	11.08747
-2527	309.729	26.91604	310.6121	-46.9366	-17.5755	309.7294	13.33622
-2517	319.5855	36.77204	320.7511	-36.8548	-14.5762	319.5859	14.23749
-2507	329.442	46.62805	330.854	-27.0957	-11.1705	329.4423	13.84794
-2497	339.2984	56.48405	340.9135	-17.6129	-7.47364	339.2988	12.35329
-2487	349.1549	66.34005	350.9237	-8.3384	-3.5976	349.1553	10.02532
-2477	359.0114	76.19606	360.8803	0.807716	0.350167	359.0117	7.183882
-2467	8.867864	86.05206	10.78107	9.90986	4.267094	8.868219	4.16656
-2457	18.72434	95.90806	20.62507	19.05071	8.05455	18.72469	1.304058
-2447	28.58081	105.7641	30.41333	28.30565	11.61686	28.58117	-1.10208
-2437	38.43729	115.6201	40.14841	37.73697	14.8608	38.43764	-2.80266
-2427	48.29376	125.4761	49.83435	47.38753	17.69626	48.29411	-3.62632
-2417	58.15023	135.3321	59.47647	57.27419	20.03838	58.15059	-3.50561
-2407	68.00671	145.1881	69.0812	67.38259	21.81151	68.00706	-2.49786
-2397	77.86318	155.0441	78.65586	77.6656	22.95459	77.86353	-0.79174
-2387	87.71966	164.9001	88.20846	88.04745	23.42686	87.72001	1.309782
-2377	97.57613	174.7561	97.74751	98.43468	23.21244	97.57648	3.43281
-2367	107.4326	184.6121	107.2818	108.7317	22.32223	107.433	5.195047
-2357	117.2891	194.4681	116.8203	118.857	20.79237	117.2894	6.270471
-2347	127.1456	204.3241	126.3718	128.7555	18.67991	127.1459	6.438397
-2337	137.002	214.1801	135.9448	138.4041	16.05689	137.0024	5.60677
-2327	146.8585	224.0361	145.5474	147.8115	13.00463	146.8588	3.810565
-2317	156.715	233.8921	155.1869	157.0137	9.609325	156.7153	1.193588
-2307	166.5714	243.7481	164.8698	166.0676	5.9594	166.5718	-2.01664
-2297	176.4279	253.6041	174.6016	175.0448	2.144649	176.4283	-5.53402
-2287	186.2844	263.4601	184.3864	-175.974	-1.74335	186.2847	-9.03625
-2277	196.1409	273.3161	194.2268	-166.905	-5.61	196.1412	-12.1849
-2267	205.9973	283.1721	204.1239	-157.664	-9.35632	205.9977	-14.6458
-2257	215.8538	293.0281	214.077	-148.174	-12.8779	215.8542	-16.1139
-2247	225.7103	302.8841	224.0839	-138.376	-16.0654	225.7106	-16.3449
-2237	235.5668	312.7401	234.1404	-128.231	-18.8067	235.5671	-15.1944
-2227	245.4232	322.5961	244.2407	-117.742	-20.9925	245.4236	-12.6612
-2217	255.2797	332.4521	254.3776	-106.95	-22.5245	255.2801	-8.91974
-2207	265.1362	342.3081	264.5426	-95.9448	-23.3265	265.1365	-4.32534
-2197	274.9927	352.1641	274.7262	-84.851	-23.3546	274.993	0.624165

Plot decl vs. 4*long.

```
A:A6: -2557
A:B6: @MOD(280.46+0.9856474*A6,360)+360
A:C6: @MOD(357.528+0.9856003*A6,360)+360
A:D6: +B6+1.915*@SIN(C6*@PI/180)+0.02*@SIN(2*C6*@PI/180)
A:E6: (180/@PI)*@ATAN2(@COS(@PI*D6/180),@COS(@PI*23.439/180)*@SIN(@PI*D6/180))
A:F6: (180/@PI)*@ATAN(@TAN(@PI*23.439/180)*@SIN(@PI*E6/180))
A:G6: @MOD(100.4602346+0.985647348*(A6-0.5)+15.041068*12,360)+360
A:H6: @IF(E6-G6<-180,E6-G6+360,E6-G6)*4
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COMMUNICATIONS SATELLITE CORPORATION

MEMORANDUM

GARY D. GORDON
Senior Staff Scientist
Spacecraft Laboratory

Mar 15, 1994

Ali,

In case you don't have access to my book, the enclosed pages may be helpful.

Hastily,

Gary