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Question 4: Does A.C.E disprove the a/R force of matter?

Hello:
Have you visited the A.C.E. spacecraft web site at http://sd-www.jhuapl.edu/ACE/ACE_FactSheet.html ? This spacecraft is in a halo orbit of the Lagrange L1 point where it generally stays in line between the earth and the sun throughout the year. The fact sheet lists the spacecraft's position as follows.
"ACE will orbit the L1 libration point which is a point of Earth-Sun gravitational equilibrium about 1.5 million km from Earth and 148.5 million km from the Sun."

Notice how the gravitational forces are in equilibrium, meaning the spacecraft is attracted to the sun by a gravitational force that is equal to the gravitational force the spacecraft is attracted in the opposite direction to the earth. My question is that if this event is occurring as you predict, with the ACE spacecraft accelerating in the sun's direction as it orbits the sun, then are you not predicting that your acceleration/Reaction force is reacting on the spacecraft's matter in the earth's direction? If so, I wonder if your a/R force is not an extra, unnecessary outward force, which if it did exist, would upset the balanced state of the spacecraft's current gravitational equilibrium which is the obvious reason the spacecraft is able to maintain its position at the L1 point throughout the year?

Please explain,
Ralph

Hello Ralph:
Your logic regarding the a/R force as being an unnecessary force in the ACE spacecraft event is without fault, provided that the information presented on the ACE fact sheet is correct in predicting that at the L1 point the ACE spacecraft truly is in gravitational equilibrium between the Earth/Moon system and the Sun. In my work, I try never to base my conclusions upon the conclusions of another unless I have thoroughly examined and verified their work. Anything less leaves one's own work without a solid basis. Logic based upon false "facts" becomes false logic.

With this thought in mind, let us examine the forces present on the ACE spacecraft at the L1 point. So far, we are told that ACE is 1.5 million kilometers closer to the Sun from Earth and further that it has an average orbital radius of 148.5 million kilometers about the Sun. This means that Earth's orbital radius is 150 million kilometers which does not quite agree with my astronomy resource which lists Earth's average orbital radius at 149.6 million kilometers. But, for this example, I will use 150 million kilometers as being correct.

My astronomy resource lists the Sun's mass as 1.989e+30 kilograms and the Earth/Moon combined mass as 6.048e+24 kilograms. Meanwhile I have learned that the mass of the ACE spacecraft is currently at 705 kilograms, down from 785 kilograms due to exhaustion of 80 kilograms of maneuvering propellant.

To begin with, you and I are in agreement that the ACE spacecraft is experiencing a balance of internal forces at the L1 point. The issue here is whether these balanced internal forces are all gravitational, as is implied on the ACE fact sheet. Let us begin by using Isaac Newton's formula to calculate the spacecraft's force of gravitation toward the Sun.

I will make these calculations using the Microsoft Windows Calculator set in scientific mode. You can follow my work here on your own computer. When entering numbers in scientific notation, enter the number including the decimal point, click [Exp] and then enter the exponent which simply indicates the number of places and direction the decimal point is shifted to arrive at the true number. The calculator assumes the exponent is positive (shifted to the right). If it is negative (shifted to the left), complete the negative exponent entry by clicking the [+/-] key one time.

SI Units - Inward Gravitational Force on ACE Spacecraft
ACE mass = 705 kg
Sun mass = 1,989,000,000,000,000,000,000,000,000,000.0 kg.
= 1.98,9e+30 kg
Distance between c/g = 148,500,000 kilometers
= 148,500,000,000 meters
= 1.48,5e+11 meters
Gravitational Constant = 0.00,000,000,006,672,59 N*m2/kg2
= 6.67,259e-11 N*m2/kg2
Newton's Formula for Gravitation
Force = Gravitational Constant x (Mass1 x Mass2 / Distance2)
Force = 6.67,259e-11 N*m2/kg2 x (705 kg x 1.98,9e+30 kg / (1.48,5e+11 m)2)
= 6.67,259e-11 N*m2/kg2 x (1.40,224,5e+33 kg2 / 2.20,522,5e+22 m2
= 4.24,293 Newton
kg.force = N / 9.8 N/kg
= 4.24,293 N / 9.8 N/kg
= 0.43 kg.f (Earth weight)

Overall, there is not much inward gravitational force on the ACE spacecraft at the L1 point since it totals a little less than the Earth weight of a one-half kilogram object. I will perform the same calculation in US Units.

US Units - Inward Gravitational Force on ACE Spacecraft
ACE mass = 1,554 lb.m
Sun mass = 4,385,000,000,000,000,000,000,000,000,000.0 lb.m
= 4.38,5e+30 lb.m
Distance between c/g = 92,273,437.5 miles
= 487,203,750,000 feet
Gravitational Constant = 3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2
force = Gravitational Constant x Mass1 x Mass2 / Distance2
= 3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2 x 1,554 lb.m x 4.385e+30 lb.m / (487,203,750,000 ft)2

= 3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2 x 28,707,764,002 lb.m2/ft2
= 1 lb.f (Earth weight)

So here we have 1 pound of inward gravitational force acting on the ACE spacecraft's matter in the Sun's direction as ACE resides at the Lagrange L1 point. Might I point out to you now that if there is an equal 1 lb gravitational force acting on ACE in the outward direction toward Earth and the Moon, as is stated to be true in the ACE fact sheet, then there can be no net inward gravitational action force toward the Sun to cause the required inward-directed acceleration in order for ACE to continue traveling the curved path of its orbit of the Sun. So already we have discovered a very serious problem in their representation of the Physics of this ACE orbital event.

Next I will calculate the outward gravitational action force on ACE due to its reception of gravitational energy emissions sent in Ace's direction from the masses of Earth and the Moon.
SI Units - Outward Gravitational Force on ACE Spacecraft

ACE mass = 705 kg
Earth/Moon mass = 6.048e+24 kg
Distance between c/g = 1,500,000 kilometers
= 1,500,000,000 meters
= 1.5e+9 meters
Gravitational Constant = 6.67,259e-11 N*m2/kg2
Force = Gravitational Constant x (Mass1 x Mass2 / Distance2)
= 6.67,259e-11 N*m2/kg2 x (705 kg x 6.048e+24 kg / (1.5e+ m)2)
= 6.67,259 e-11 N*m2/kg2 x (4.26,384e+27 kg2 / 2.25e+18 m2
= 0.12,6 Newton
kg.force = N / 9.8 N/kg
= 0.12,6 N / 9.8 N/kg
= 0.01,3 kg.f (Earth weight)

Hmmm. An outward 0.01,3 kg.force toward Earth and the Moon is considerably less than an inward 0.43 kg.force toward the Sun. In fact it is about 33 times less. Let's do the same calculation in Universal System units for confirmation.

US Units - Outward Gravitational Force on ACE Spacecraft
ACE mass = 1,554 lb.m
Earth/Moon mass = 1.33,334,208e+25 lb.m
Distance between c/g = 932054.92,424 miles
= 4,921,250,000 ft
Gravitational Constant = 3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2
force = Gravitational Constant x (Mass1 x Mass2 / Distance2)
= 3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2 x (1554 lb.m x 1.33,334,208e+25 lb.m / (4,921,250,000 ft)2)
= 3.32,199,885,554,075,5e-11 lb.f*ft2/lb.m2 x (2.07,201,359,232e+28 lb.m2 / 2.42,187,015,625e+19 ft2
= 0.02,8 lb.f (Earth weight)

Again we have an outward gravitational action force toward the Earth/Moon system of 0.02,8 pounds which is also 1/33 times as much as the inward gravitational action force toward the Sun of 1 pound. Experiencing just these two opposing, yet considerably unequal, gravitational action forces, would you describe the ACE spacecraft as being in "gravitational equilibrium" at the L1 point? I think not. So why are we told such a "fact" by the scientists responsible for reporting on the ACE spacecraft program? Did they make an error in calculating the magnitudes of the gravitational forces acting on ACE at the L1 point? Not likely. If they were seeking out the real point of "gravitational equilibrium" these scientists would have ignored Lagrange's prediction and attempted instead to position ACE in the Sun's direction but well inside the Moon's orbital distance from Earth.

I think the reason we are told that ACE resides in "gravitational equilibrium" is because ACE is obviously in "equilibrium" at the L1 point and gravitational forces are the only forces these scientists will even consider as being present in ACE at the L1 point. I say "consider" for scientists in general are today taught that even "gravitation" is not really a force. I wonder what they must be thinking when they check the force of their own Earth gravitational weights by standing atop ordinary compression scales at home?

Understand that for ACE, at the L1 point of equilibrium between the Sun in one direction and the Earth/Moon system in the opposite direction, there does exist an equilibrium of internal action and reaction forces. Sunward acceleration is occurring to ACE due to a net inward gravitational action force that equals the vector sum of the two gravitational action forces we just calculated. When the 1 lb.f toward the Sun is added to the - 0.02,8 lb.f toward the Earth/Moon system, the result is a 0.97,2 pound force that is the acceleration/Action force responsible for causing ACE to accelerate toward and thereby travel the curved path of its orbit of the Sun.

To verify the presence of this 0.97,2 pound acceleration/Action force, let us first pretend the Sun is missing from the center of this solar system, and then we will calculate the inward-directed external (contact) force required to cause the ACE spacecraft to follow a circular path with a radius equal to its average distance from the now missing Sun. Hopefully, this calculated centripetal (inward-directed) action force will be close in magnitude to the 0.97,2 net gravitational acceleration/Action force that is currently responsible for ACE's actual inward acceleration.

US Units - Inward Accelerative Action Force on ACE Spacecraft
ACE mass = 1554 lb.m
ACE radius of orbit = 487,203,750,000 ft
ACE distance/rev = 2 x pi x radius
= 3,061,188,857,925 ft
g = 32.17 ft/sec2
ACE time/rev = 365.25 days x 24 hours/day x 60 min/hour x 60 sec/min
= 31,557,600 sec
ACE orbital speed = distance/rev / time/rev
= 3,061,188,857,925 ft / 31,557,600 sec
= 97,003.22 ft/sec

Now, with the Sun absent from the center of orbit, what we want to know is how much inward-directed force is required to be impressed by whatever means against the matter of a 1,554 pound spacecraft traveling at the speed of 97 thousand and three feet/sec to change its rest-motion to instead follow a curved path along the circumference of a circle with a radius equal to 487,203,750,000 feet.

Beginning with Force = mass x acceleration, Newton used his calculus to prove that inward-directed acceleration of an object as it followed a circular path at a steady speed was equal to speed2 / radius. The resulting formula is Force = mass x speed2 / radius. I will add /g to convert the absolute Force units of the Poundal or Newton to the more commonly used units of lb.f or kg.f.

force = mass x speed2 / radius / g
= 1554 lb.m x (97,003,.22 ft/sec)2 / 487,203,750,000 ft / 32.17 ft/sec2
= 0.93,3 lb.force

I think it is safe to say that we have reached our goal of determining that an average gravitational acceleration/Action force of about a 0.95 pound magnitude is responsible for causing the inward-directed acceleration of the ACE spacecraft about the Sun. We know from Article III: The Equality of Opposing Forces, that whenever a force exists, an equal and opposite force is always immediately present. This inward-directed 0.95 pound acceleration/Action force is no exception. Just as it is impressed internally within the myriad of components of ACE's matter, so its equal and opposite 0.95 pound acceleration/Reaction force is equally present and reacting internally within the same myriad of weightless components of ACE's matter while providing the required support and termination for the net gravitational acceleration/Action force responsible for causing the satellite's inward-directed centripetal acceleration.
So there you have it, Ralph. The a/R force is not an extra, unnecessary outward-directed force that upsets the balanced state of "gravitational equilibrium" of ACE at the L1 point. Quite the contrary is true. The a/R force is present and fully needed to achieve the balanced state of internal equilibrium that the accelerating ACE spacecraft is currently enjoying at the L1 point, as correctly predicted so long ago by Joseph Louis Lagrange (1736-1813).

Sorry for all the calculations. Recognize that they do serve to verify that the acceleration/Reaction force has an important supporting role to fill. A role, I might add, that is completely ignored by scientists during this event and likewise during every other event involving acceleration that they try in vain to correctly explain. If you find another such example on the Internet, please send it along.

Thanks for your help in this matter, Ralph,

Ethan Skyler