Negative mass masquerading as positive mass; and what happened to all the antimatter?

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Abstract

All masses measured in a laboratory using simple measurement methods must give outcomes as positive or zero masses. A method is given in principle to determine between negative and positive masses for matter and antimatter particle pairs.

Negative mass masquerades as positive mass and simple measurements would always show negative mass to have apparent positive mass. This means that antimatter particles could have negative masses despite measurements showing them to have positive masses. If antimatter has negative mass masquerading as positive mass then antimatter cannot form lumps in the same way that matter does. Antimatter would then be the main component of dark energy, which would answer the question of what happened to all the antimatter.

Introduction

A vixra paper by Hyoyoung Choi (2009) explores the possibility that negative mass causes both dark matter and dark energy. A vixra paper by Fearnley (July 2018) supported the idea that negative masses cause, simultaneously, the effects of both dark matter and dark energy, and illustrated this using computer simulations to plot 1-Dimensional motions of a small number of positive and negative masses under basic laws of motion.

The equations governing the motions of positive and negative masses under gravitational forces are described in detail in Choi (2009) and the oddity of runaway motion is highlighted in Wikipedia (2018):

"Positive mass attracts both other positive masses and negative masses.
Negative mass repels both other negative masses and positive masses.
For two positive masses, nothing changes and there is a gravitational pull on each other causing an attraction. Two negative masses would repel because of their negative inertial masses. For different signs however, there is a push that repels the positive mass from the negative mass, and a pull that attracts the negative mass towards the positive one at the same time."

In this paper, it is noted that 'positive mass attracts both other positive masses and negative masses' is the key to knowing that all masses, both positive and negative, will appear as positive masses when measured using simple measurement methods, for a naïve example using counterbalanced weighing scales. Negative masses will masquerade in the laboratory as positive masses. This will be true as laboratory measurements are made in a matter-dominated environment and in that matter-dominated environment, all positive and negative masses will be attracted to the earth by gravity or to whatever lump of positive matter is providing the basis or test source of gravitation. It is difficult to provide a lump source of negative mass because negative mass is believed (Choi [2009], Fearnley [2018]) to be the cause of dark energy which repels itself throughout available space in the absence of nearby normal matter. It is hard to foresee negative mass as being able to form lumps of matter in the same way that positive mass can do.

Method of measurement to distinguish positive and negative masses: a thought experiment

A method of measurement is needed to distinguish between positive and negative masses. Suppose that the gravitation between two positive masses of +400 units and +1 unit is required to be measured. Say the two masses (M_1 and m_2) are initially at rest at one unit of distance apart (r=1).

The force between the two masses is proportional to M_1*m_2/r^2. That is proportional to 400 units of force.

As both masses are positive the force acts to bring the two masses together.

Force = mass * acceleration, so $M_1* a_1 = m_2* a_2$, so $400 * a_1 = a_2$.

Next, calculate the distances the two masses travel in unit time in free space, using basic equations of motion:

$S_1 = u_1*t + 0.5*a_1*t^2$

And $S_2 = u_2*t +0.5*a_2*t^2$

where $u_1 = 0$, $u_2 = 0$ and $t = 1$.

Thus $S_1 = 0.5*a_1$

And $S_2 = 0.5*a_2 = 200* a_1$

So $S_2 = 400* S_2$.

The force was calculated as a proportionality so this tells us that the small mass moved 400 times the distance moved by the large mass. Both masses moving closer together.

Next, we repeat this measurement but with a mass of -1 replacing the mass of +1.

This time the force has a negative sign because the force between the two masses is proportional to M_1*m_2/r^2 and on this occasion m_2 is negative. So the force acts in a way which would move two positive masses away from each other. Now the +400 mass is positive mass, so this large positive mass now moves away from the small mass. But the small mass has negative mass and as force = $m_2 * a_2$ then the force accelerates the small mass towards the large mass once again as in the previous case. So the change in sign of the force is nullified by the change in sign of the small mass.

The absolute sizes of the numbers resulting are the same on each occasion so the small mass moves 400 times further than the big mass moves, but on the second occasion the big mass moves away from the small mass rather than towards it.

This is the way in which a negative mass can, in principle, but not easily in practice, be detected. That is, by the effect on a positive mass caused by a negative mass. There is no way of detecting a negative mass by weighing/measuring an effect on the negative mass alone, which will always masquerade as a positive mass.

Discussion

It is not clear if antimatter particles should have genuine, rather than masquerading, negative mass. However, if antimatter particles did have genuine negative mass then it could explain why the universe appears to be made of matter and not antimatter. Antimatter could be the stuff of dark energy (and dark matter). In Fearnley (July 2018) it is speculated that neutrinos could be the stuff of dark energy. The neutrino is an odd particle and maybe it is the neutrino rather than the antineutrino which has negative mass (if either).

It strikes as very odd that the breaking of symmetry between positive and negative mass is so different and catastrophic. One can imagine a global reversal such that all the positive and negative electric charges swapped places so that the atom had a heavy negative nucleus etc. Unlikely, but imaginable. But it seems that one cannot make the universe out of large lumps of matter with negative mass. That is a strange effect of a simple sign flip.

As an aside, in my non-mathematical preon model, the issue of antimatter is complicated by levels. Antimatter at elementary particle level in the Standard Model is, according to my preon model, a mixture of matter and antimatter at the level of preons. This is a complication which implies that normal positive masses of elementary particles may have negative masses within them masquerading as normal positive masses. Mass is currently not included in my preon model as a fundamental property of an elementary particle. That is mainly because I did not previously trust mass as a fundamental because it seemed only to be positive. All other fundamental properties appeared as +/- pairs. But mass can (probably) be added to the preon model as a fundamental property.

Another issue is that the nature of mass seems to be relative to the observer in that the observer in a matter-dominated universe measures all masses as positive. Whereas it could be that the total mass should be zero. That makes dark matter appear to be masquerading as positive mass. But this is a different kind of masquerading than discussed above. In the thought experiment in the above section, it is assumed that the position of the negative mass is known and measurable. For dark matter in galaxies, it is not clear to me that the negative-mass version of dark matter really would be where dark matter is calculated to be, so both the sign and location of the dark matter could be masquerading. It is also not clear to me whether or not dark energy is generally viewed as negative mass but in Fearnley (July 2018) dark energy is an effect simulated using negative mass.

Some problems in dark matter locations are known as 'cusps, cores and satellites'. If negative masses cause dark matter then these problems may diminish. The distribution of dark matter would be dynamic as matter tries to flee from dark matter while dark matter chases matter. Also dark matter with negative mass will repel itself so that maybe the centres of galaxies are less dense in dark matter than would be the case for dark matter consisting of genuinely positive mass.

Postscript - the missing antimatter

My suggestion is that any antimatter with electromagnetic properties will have long ago annihilated with electromagnetic matter leaving behind only the neutrinos and antineutrinos not annihilated. The oddity is why there is any matter left over today and not annihilated in the early universe. It is suggested here that in the early universe some of the antimatter (assumed to be signed with negative mass) could not keep up with the positive mass in a 'runaway motion' effect (Wikipedia, 2018). In a computer toy simulation in Fearnley (July 2018) it was found that 35 per cent of dark matter could be left behind in the race to catch the runaway normal matter. So, of the initial total matter, say, one-third could be normal matter, one-third left-far-behind antimatter and less than one-third annihilated. With neutrinos and antineutrinos remaining. Neutrinos are also constantly being emitted in the universe.

Negative-mass antineutrinos would be implicated in both dark energy and dark matter while the positive-mass neutrinos would only be involved in dark matter. (Reverse that if neutrinos are so eccentric that it is the neutrino that has the negative mass.)

The effects of applying ordinary equations of motion to positive and negative masses are shown below.

A positive mass accelerates towards a positive mass

This is mainly normal matter in motion. Normal matter is positive mass and is on the right hand vertical line in Figure B below, which has been annotated after being extracted from Fearnley (July 2018). The two vertical lines should be a single line as this simulation only uses one dimension of space but the line is separated to show more clearly the positions of the negative and positive masses. Positive-mass neutrinos are also attracted gravitationally to normal matter and form a positive-mass component of dark matter.

A negative mass accelerates towards a positive mass

This is the main cause of negative-mass dark matter. Some of the negative mass acting as dark energy is attracted to the normal matter, in say galaxies, and surrounds the galaxies. See the red circles on the left hand vertical line in Figure B. The **red** circles identify negative mass clumps as dark matter. The right hand vertical line of positive mass in Figure B shows two **blue** circles representing, say, two galaxies corresponding to the two clumps of dark matter in red. Again, there is really only one vertical line so the left and right lines should be viewed as coincident.

A positive mass accelerates away from a negative mass

This is a contributory factor to dark matter. The negative mass surrounding a galaxy repels the mass in the galaxy away from edges of the galaxy and towards the galactic centre. In the absence of the concept of negative mass, it has been assumed that dark mass is only a positive mass in the galaxy attracting the galaxy towards the galactic centre. The negative mass is a mass surrounding the galaxy and repelling the galaxy from expanding. Thus the mass in the galaxy itself does not take part in the expansion of the space between galaxies. That is, a dark energy effect is not apparent within a galaxy because of the negative-mass dark matter effect within the galaxy.

A negative mass accelerates away from a negative mass.

This is the main component of dark energy as negative mass repels itself throughout the universal space available to it. The normal mass is carried along with the negative mass and galaxies accelerate away from each other. Some of the negative mass indicated at the foot of Figure B can be left behind the runaway motion and ought to match in absolute magnitude the mass of the normal matter in the universe. The mass of the neutrinos ought to match the mass of the antineutrinos. Measurements of mass in the universe are always positive and so the true balance of positive and negative masses is hidden from measurement.

Negative masses within the galaxy repel other negative masses so that the negative-mass dark matter is a shell around a galaxy rather than mainly residing in the galaxy.

There may also be a central cloud of negative mass surrounding a black hole at the galactic centre.

In Figure B, the two galaxies were 18 units apart. In Figure A they had only been three units apart at an initial stage while in Figure C at a later stage they became 40 units apart and this demonstrated a dark energy effect. (See Table 1 of Fearnley, July 2018.)

Figure B: Scatterplot of 100 masses against position
(Time = 20 cycles; masses are -1 and +1; scaling factor = 0.01)

References

Fearnley, A.J. (July 2018) *"Negative Mass as a Cause of Dark Matter and Dark Energy"* http://vixra.org/abs/1807.0264

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