

Re: equivalence of inertial mass and gravitational mass

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On 26 Dec 2004 09:31:54 -0800, h56234@yahoo.com wrote:

>Hi.

>I am told that in Newtonian physics the equivalence of inertial mass
>and gravitational mass is only coincidental. I am having a hard time
>understanding this distinction being made between the two types of
>masses. A little thought experiment: we take two stationary point
>objects A and B and apply 1 newton on each of them. Say we observe
>that their rates of acceleration are the same, and thus their inertial
>masses are equal. Now we put the two objects in the same gravitational
>field and observe that their accelerations are the same. Thus we say
>that there is a force G acting on the objects which is proportional to
>the objects' inertial masses. So how do you define gravitational mass
>at this point?

>

>Thanks in advance for any assistance.

>

>Matt. H

The inertial and gravitational masses are identical in their action.

Every mass that is accelerating along x is subject to the Navier Stokes law

$$dP/dx = -\rho \cdot a \text{ where } \rho \text{ is the mass density}$$

This means that every point in that object has the same acceleration, governed by pressure gradient and density:

$$a = -(dP/dx)/\rho$$

It can be illustrated very simply (as in pg.79 of my book Dual Space) by using a block with area and lengths A x L and subject to force F and pressure P:

$$a = F/m = PA/pAL = P/pL = -dP/pdL$$

with force and pressure being maximum at rear tapering to zero at front thus the minus sign.

Now set the same block down subject to gravity, and notice that gravity induces the same pressure gradients, with maximum force at the table, tapering to zero at the top. It is exactly counterbalancing gravity

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because it's not moving.

In the first example the inertia is resisting force F and in the second it's acting the same way with gravity gripping at those same molecules.

The pressure gradient would be a function of the shape.

Notice that if the pressure gradient is maintained for some time, the mass will have acquired velocity V which it will retain forever, unless we somehow subject that mass to a reverse pressure gradient for a suitable time.

That's probably as close as you can get to 'proving' it.

John Polasek

If you have something to say, write an equation.

If you have nothing to say, write an essay