Dear editors,

With every new revelation from our space telescopes, the λCDM model of Cosmology becomes more untenable. It appears to a casual observer this model no longer agrees with itself. Academics have settled into a familiar pattern where they question whether some fundamental assumption is wrong. Then, convinced that they've missed nothing, modified gravity is briefly considered as a solution and then treated like an embarrassing relative you must acknowledge before dismissing. Inevitably the community moves on to an excited and prolonged discussion of new physics and new particles. Cosmologists certainly are crazy. It is far easier to publish a paper about the precise nature of something that doesn't exist and can't be disproven, than to question an old assumption that has become an axiom.

On the surface of the Earth, the acceleration due to the curvature of spacetime is $9.8\ m\ s^{-2}$. If we want to objectively measure the proper acceleration between two objects, we must remove this noise. A clever pendulum experiment can remove most of it, but then what of the sun? The median acceleration due to the influence of the sun is $5.9 \times 10^{-3}\ m\ s^{-2}$ and the amplitude of this signal will oscillate with each day on the order of $10^{-6}\ m\ s^{-2}$ in a terrestrial laboratory due to the diameter and rotation of the Earth. **So, any experiment that demonstrates that two objects at rest remain at rest is wrong because we know for certain there is non-linear motion here to be detected.**

Given the amount of noise in a terrestrial laboratory, the only objective statement about freefall motion that can be made is that objects at rest accelerate at some value, a_3. This value may be zero and it may not, but it is irrational to assume without evidence. Substituting a parameter for an assumption, the Geodesic Equation becomes:

$$\frac{d^2\vec{x}}{d\tau^2} = \frac{d\vec{u}}{d\tau} = \overrightarrow{a_3}$$

$$\frac{d(u^\alpha \overrightarrow{e_\alpha})}{d\tau} = a_3^\alpha \overrightarrow{e_\alpha}$$

Which can be expanded with the chain rule:

$$u^\alpha \frac{d\overrightarrow{e_\alpha}}{d\tau} + \frac{du^\alpha}{d\tau}\overrightarrow{e_\alpha} = a_3^\alpha \overrightarrow{e_\alpha}$$

$$\frac{d\overrightarrow{e_\alpha}}{d\tau} = \Gamma^\gamma_{\alpha\beta} u^\beta \overrightarrow{e_\gamma}$$

$$\Gamma^\gamma_{\alpha\beta} u^\alpha u^\beta \overrightarrow{e_\gamma} + \frac{du^\alpha}{d\tau}\overrightarrow{e_\alpha} = a_3^\alpha \overrightarrow{e_\alpha}$$

$$\Gamma^\alpha_{\mu\nu} u^\mu u^\nu + \frac{du^\alpha}{d\tau} = a_3^\alpha$$

Where $\frac{du^\alpha}{d\tau}$ is the proper acceleration of an object, and $\Gamma^\alpha_{\mu\nu}u^\mu u^\nu$ is the acceleration caused by a fictitious force (that is, the change in the basis vector with time). Making no assumptions about the acceleration of objects in freefall, the geodesic equation is:

$$\frac{du^\alpha}{d\tau} = a_3^\alpha - \Gamma^\alpha_{\mu\nu}u^\mu u^\nu$$

In non-relativistic domains, the equation for the motion of a free-falling particle with a mass of m in the presence of a collection of fictitious forces, $\sum F$, is:

$$\sum_{\mathrm{i}} \boldsymbol{F_i} = \frac{d\boldsymbol{P}}{d\tau}$$

$$\sum_{\mathrm{i}} F_i^\alpha \overrightarrow{e_\alpha} = \frac{dP^\alpha}{d\tau}\overrightarrow{e_\alpha}$$

$$\sum_{\mathrm{i}} F_i^\alpha \overrightarrow{e_\alpha} = \mathrm{m}\frac{du^\alpha}{d\tau}\overrightarrow{e_\alpha}$$

$$\sum_{\mathrm{i}} F_i^\alpha \overrightarrow{e_\alpha} = \mathrm{m}(a_3^\alpha - \Gamma^\alpha_{\mu\nu}u^\mu u^\nu)\overrightarrow{e_\alpha}$$

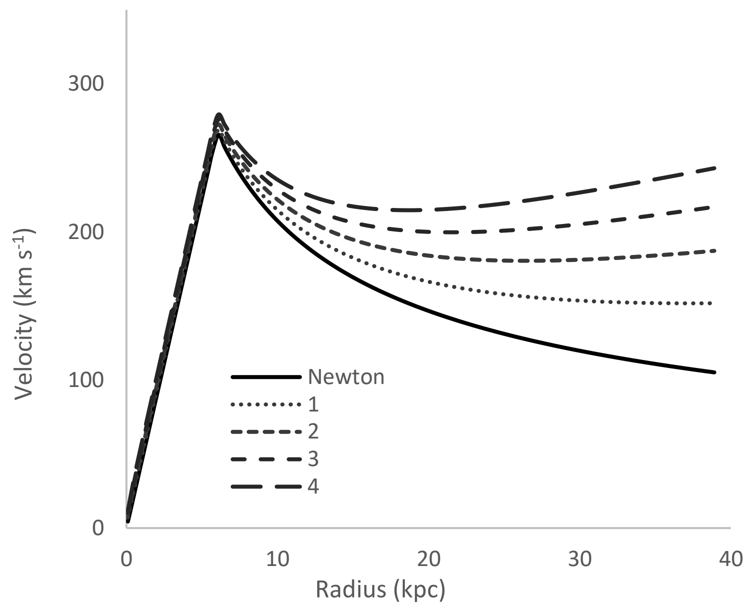
Where $\boldsymbol{P}$ is the momentum vector. We can derive a formula for orbital motion in a gravitational field by replacing the general terms of this equation with more specific terms.

$$-\frac{GMm}{r^2}\vec{r} = m\left(a_3 - \frac{v^2}{r}\right)\vec{r}$$

$$\frac{v^2}{r} = a_3 + \frac{GM}{r^2}$$

$$v = \sqrt{a_3 r + \frac{GM}{r}}$$

Where G is the gravitational constant, M is the mass within a radius, r, and v is the tangential velocity of an object at the given radius.



This figure depicts the velocity curves of orbital motion around a spherical mass of $10^{11}\ M_{\odot}$ having a radius of 6 kpc and constant density, for a variety of freefall accelerations (in units of $10^{-11}\ m\ s^{-2}$). Note that at a value of $a_3 = 0$, we recover Newtonian Mechanics. At higher values of a_3, we see a flattening of the velocity curve on a galactic scale without the need for new physics or new particles. This interpretation of the Geodesic Equation is not only compatible with General Relativity, but fixes GR on large scales. And all we've done to achieve this result is removed one assumption.