

Quantum Gravity 154.7: Gravity Overtaken by Expansion Above a Certain Radius

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From Osher Doctorow

Let's consider the equation motivated by the previous posts:

$$1) F_{\text{expansion}} = k/r^{(1/2)}$$

where $r^{(1/2)}$ is of course \sqrt{r} for r radius or principal radius or similarly of the Universe (from some particular point), and where $F_{\text{expansion}}$ is the Expansion Force for inflation and/or the Cosmological Constant, Chalyapin gas, Quintessence, etc.

Comparing this with the Newton Law of Universal Gravitation:

$$2) F_g = Gm_1m_2/r^2$$

we notice that:

$$3) F_{\text{expansion}} > F_g \text{ iff } k/r^{(1/2)} > Gm_1m_2/r^2$$

and incorporating constant into k (or rewriting $k' = Gm_1m_2/k$) we get:

$$4) 1/r^{(1/2)} > k'/r^2 \text{ iff } r^{(3/2)} > k' \text{ iff } r > (k')^{(2/3)} = k''$$

where k'' is a constant defined as $(k')^{(2/3)}$.

So below radius k'' , $F_g > F_{\text{expansion}}$, and below it $F_{\text{expansion}} > F_g$.

We don't necessarily have to consider this equation as holding throughout time for the Universe, and there may be extra terms or factors for the constant or slower expansion phases preceding later accelerations, but at least for the earliest Universe it expresses an initial stronger phase of gravitation than of expansion followed at a critical radius r'' by the opposite. And at list piecewise or on particular intervals, similar equations can hold for late acceleration scenarios.

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What about the usual idea that r increases at least exponentially during Inflation? $1/r^{(1/2)}$ is closer to exponential than $1/r^2$ above $r = 1$, so at least we're going arguably in the right direction.

Osher Doctorow

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