Review of: "Dimensional Reduction as Source of Cosmological Anomalies"

Tichomir Tenev

Potential competing interests: No potential competing interests to declare.

The article introduces the idea of dimensional reduction (DR) as a means to boost gravitational influence thus hinting at a potential explanation for the currently observed gravitational anomalies that are commonly attributed to the presence of dark matter, or “dark matter effect” hereon.

As stated in the abstract and in the concluding paragraphs of the paper, DR is hypothesized to have happened during the early, high-energy, phases of the universe, but the dark matter effect is observable today. Thus, the relevance of DR to explaining the dark matter effect remains unclear. The author needs to make a clear connection between the role of DR and the objectives set out in the abstract to “a) … explain some of the observed anomalies challenging the standard model of cosmology and, b) provide a platform for unifying the particle and gravitational interpretations of Dark Matter.”

A peculiar aspect of the dark matter effect is that the ratio between the hypothetical dark matter and visible matter can vary significantly from galaxy to galaxy by as much as 100 times. This poses a problem for any explanation that is based on tweaking the fundamental gravity laws, such as DR in this case, MOND as another example, or anything else like that. Whatever is behind the dark matter effect must have a localized cause in addition to any law tweaking that one may envision. For example, actual dark matter as the explanation for the dark matter effect fits this requirement of locality (but has other problems.) Another possible explanation is that space itself has inherent curvature that is uncaused by matter, as I have suggested in doi.org/10.1142/S0218271819500822, and that such curvature can vary from location to location. Along the same lines, if the author decided to use DR as an explanation for the dark matter effect, the author will have to show not only that DR is still taking place today, but that the degree of dimensionality reduction varies from location to location. It would also strengthen the paper to do some calculations with dark matter data from several galaxies and determine what sort of DR reduction would be required to produce the observed effects.

In addition to the above general comments, I noticed a small error in Equation (4), where the dimensions of Force are equated to those of mass. This is incorrect. Under no system of units do the dimensions of force equate to mass. For example, in geometric units, Force is dimensionless but mass has the units of length, while in SI units, force is mass*acceleration. Nevertheless, this error does not affect significantly the rest of the paper.