New MOND theory able to account for cosmic microwave background

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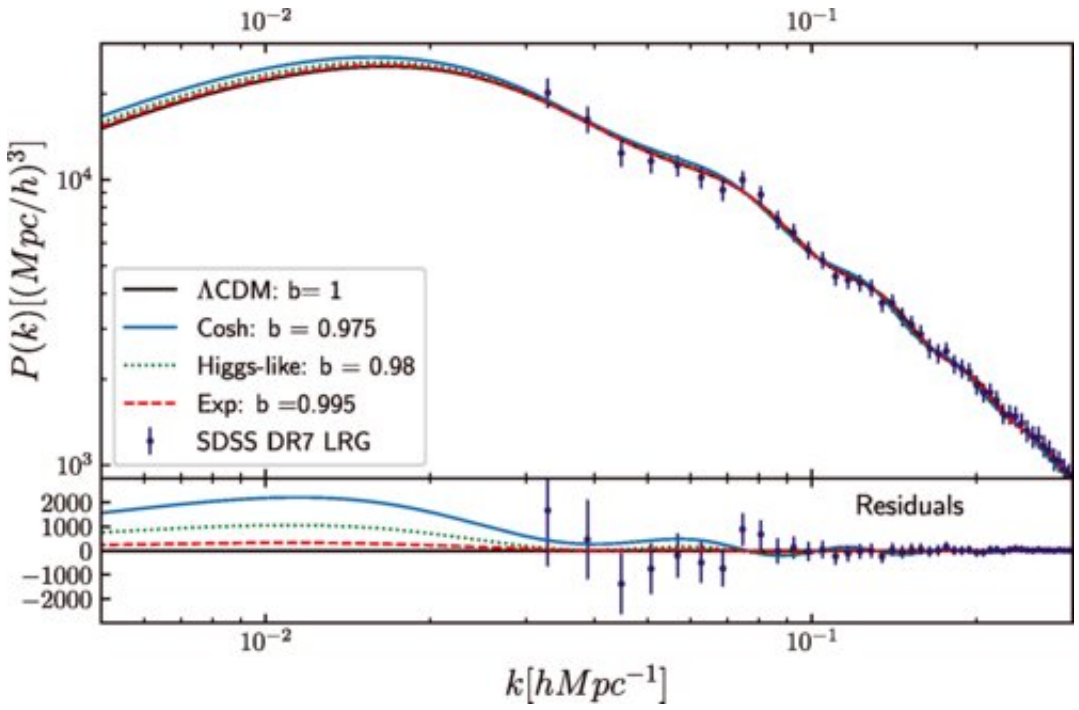

The linear MPS P(k) for the models showing excellent fits to the Sloan Digital Sky Survey (SDSS) data release 7 (DR7) luminous red galaxies (LRG) [105]. We also include a bias parameter b. Note that the (derived) Hubble constant for each model is different. Credit: DOI: 10.1103/PhysRevLett.127.161302

A pair of researchers at the Czech Academy of Sciences has been shaking up the astrophysics community with a new modified Newtonian dynamics (MOND) theory that tosses out the concept of dark matter and instead backs up theories that suggest there is a type of as-yet

undiscovered gravity responsible for attributes seen in the cosmic microwave background (CMB). Constantinos Skordis and Tom Zlosnik have published a paper describing their ideas in *Physical Review Letters*.

For several years, many in the astrophysics community have used the idea of dark matter to explain phenomena that could not be explained in conventional ways—gravitational lensing, for example, or gravitational wave speed measurements found in the CMB. Others have been less willing to accept dark matter because of the lack of physical evidence of its existence. Some have suggested instead that there might be another kind of gravity at work that might explain such observations. These MOND theories have not carried much weight, however, because they cannot account for the features seen in the CMB. That appears to have changed as Skordis and Zlosnik are claiming that they have built a MOND model that does account for such data, and still accounts for gravitational lensing.

The new model begins by using the original MOND idea of two types of fields that behave together as a type of gravitational force—one is scalar, the other vector-based. Next, the researchers added parameters that suggested gravity-modifying fields generated in the early universe—ones that mimicked dark matter. These fields, they further suggest, evolved over time until they became the type of force described by the original MOND model.

Skordis and Zlosnik suggest their model can be used to explain both gravitational lensing and data in the CMB. Up next, they plan to find out if it can also explain the universe's lithium abundance and discrepancies in measurements of the cosmic expansion rate—something dark matter theories have failed to do. They also note their ideas are also free of ghost instabilities.

More information: Constantinos Skordis et al, New Relativistic

Theory for Modified Newtonian Dynamics, *Physical Review Letters* (2021). DOI: 10.1103/PhysRevLett.127.161302