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New gravitational degrees of freedom as a solution to the dark matter problem.

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Cosmological and astronomical observations indicate that the majority of mass and energy density of fields in the universe are in a form which interacts extremely weakly, if at all, with light. The standard interpretation is the existence of dark matter, commonly thought to be in the form of particles not part of the standard model of particle physics. At present a firm detection of such a particle is lacking, and moreover, all these observations concern a mismatch between the observed dynamics of visible matter with its gravitational influence. Hence, a less explored interpretation is that the underlying theory of gravity may not be General Relativity. A hint that this may be the case is the observation by Milgrom that discrepancies concerning galaxies are controlled by a single, seemingly universal, acceleration scale.

In this talk, I will discuss this possibility and focus on a particular relativistic realization constructed to reproduce Milgrom's Modified Newtonian Dynamics law at the scale of galaxies. I will show that this proposal leads to (i) correct gravitational lensing on galactic scales, (ii) tensor modes propagating at the speed of light, and (iii) cosmological evolution in line with observations of the Cosmic Microwave Background anisotropies and the large-scale structure power spectrum.

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Session Classification: Cosmic Backgrounds from Radio to Far-IR

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