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# Interpretation of galaxy rotational curves

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After more than 40 years of observational, experimental, and theoretical efforts, the nature of dark matter (DM) remains unknown. In this talk I will review the observational status of the DM paradigm on galaxy scales. Remarkably, the rotation curves of disk galaxies reveal a close link between baryons' distribution and observed dynamics, which can be expressed by a set of empirical laws akin to Kepler's laws for planetary systems. A tight baryon-DM coupling is unexpected in the standard LCDM paradigm. To reproduce such coupling, either the galaxy formation process must be very fine-tuned or the DM particle must somehow interact with baryons beyond standard gravity. Intriguingly, the empirical laws of galactic rotation were predicted a-priori by Milgrom's Modified Newtonian Dynamics (MOND), which alters Newton's laws at low accelerations (weak gravitational fields) rather than adding particle DM. One possible way to distinguish between particle DM and MOND is the so-called external field effect, which results from the breakdown of the Strong Equivalence Principle in the MOND regime. I will describe recent efforts to test the MOND external field effect and discuss other possible tests to distinguish between the two paradigms.

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