



# The case for testing MOND using LISA Pathfinder

Joao Magueijo, Ali Mozaffari

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We quantify the potential for testing MOdified Newtonian Dynamics (MOND) with LISA Pathfinder (LPF), should a saddle point flyby be incorporated into the mission. We forecast the expected signal to noise ratio (SNR) for a variety of instrument noise models and trajectories past the saddle. For standard theoretical parameters the SNR reaches middle to high double figures even with modest assumptions about instrument performance and saddle approach. Obvious concerns, like systematics arising from LPF self-gravity, or the Newtonian background, are examined and shown not to be a problem. We also investigate the impact of a negative observational result upon the free-function determining the theory. We demonstrate that, if Newton's gravitational constant is constrained not to be re-normalized by more than a few percent, only very contrived MONDian free-functions would survive a negative result. Finally we scan the structure of all proposed relativistic MONDian theories. We conclude that only the Einstein-Aether formulation would survive a negative result.

Subjects: **Cosmology and Extragalactic Astrophysics (astro-ph.CO)**;  
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