

Fifth Force Searches in Galaxies

Tuesday 4 June 2019 17:10 (20 minutes)

Fifth forces generically follow from new dynamical fields, and hence are ubiquitous in extensions to the standard model. Broad classes of Lagrangian exhibit “screening mechanisms” which hide the fifth force in high-density environments such as the Milky Way, while keeping it operative on larger scales. I will describe the search for screened fifth forces on the scale of galaxies and their environments. First, I model the gravitational environments of the local Universe to determine the screening properties of real galaxies and the strength of the fifth-force field over space. I then use this information to forward-model two signals – displacement between stellar and gas mass centroids and warping of stellar disks – and hence constrain fifth-force parameters with a Bayesian likelihood formalism. Taking 11,000 HI detections from the ALFALFA survey and 4,000 images from the Nasa Sloan Atlas I show both signals to give evidence for a Chameleon- or Symmetron-screened fifth force of range ~ 2 Mpc and strength $\sim 0.02 G_N$, but caution that unmodelled systematics such as baryonic physics may impact the inference at this level.

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Session Classification: Afternoon 21