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Self-interacting dark matter, a dark force, and galaxy anomalies

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Abstract: A large amount of data from dwarf galaxies to galaxy clusters appears to indicate that dark matter (DM) acts like a collisional fluid at galaxy scales to a collisionless fluid at the scale of galaxy clusters. We will discuss a particle physics model with the standard model extended with a gauged abelian hidden sector to explain this phenomenon. In this model dark matter consists of fermions of the hidden sector and they have self interactions via exchange of dark photons which constitute
a new dark force in the model. The analysis involves solutions to Boltzmann equations coupling the visible sector and the hidden sectors at different temperatures, one for each sector. The model produces a velocity - dependent DM cross section where the DM acts like a collisional fluid at small galaxy scales and acts collisionless at large galaxy scales, and we fit the data including those from THINGS, LSB and the Bullet Cluster. The talk is based on the paper Phys. Rev. D 103, 075014 (2021), arXiv: 2008.00529 [hep-ph], by Amin Aboubrahim, Wan-Zhe Feng, Pran Nath, and Zhu-Yao Wang.

Authors: ABOU IBRAHIM, Amin (Institute for theoretical physics, Münster University); WANG, Zhu-Yao (Northeastern University); NATH, Pran (Northeastern University); Prof. FENG, Wan-Zhe (Center for Joint Quantum Studies and Department of Physics, Tianjin University)

Presenter: WANG, Zhu-Yao (Northeastern University)

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