Contribution ID: **67** Type: **not specified**

Phenomenology: Dark Matter in Fractional Gravity I: Astrophysical Tests on Galactic Scales

Tuesday, September 5, 2023 3:00 PM (15 minutes)

We explore the possibility that the dark matter (DM) component in galaxies may originate fractional gravity. In such a framework, the standard law of inertia continues to hold, but the gravitational potential associated to a given DM density distribution is determined by a modified Poisson equation including fractional derivatives (i.e., derivatives of non-integer type), that are meant to describe non-local effects. We derive analytically the expression of the potential that in fractional gravity corresponds to various spherically symmetric density profiles, including the Navarro-Frenk-White (NFW) distribution that is usually exploited to describe virialized halos of collisionless DM as extracted from N−body cosmological simulations. We show that in fractional gravity the dynamics of a test particle moving in a cuspy NFW density distribution is substantially altered with respect to the Newtonian case (i.e., basing on the standard Poisson equation), mirroring what in Newtonian gravity would instead be sourced by a density profile with an inner core. We test the fractional gravity framework on galactic scales, showing that: (i) it can provide accurate fits to the stacked rotation curves of galaxies with different properties; (ii) it can reproduce to reasonable accuracy the observed shape and scatter of the radial acceleration relation (RAR); (iii) it can properly account for the universal surface density and the core radius vs. disk scale-length scaling relations. Finally, we discuss the possible origin of the fractional gravity behavior as a fundamental or emerging property of the elusive DM component.

Presenter: BENETTI, francesco (SISSA)

Session Classification: Parallel Sessions