

Constraints on long-range neutrino self-interactions from large-scale structure

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Upcoming cosmological surveys will probe the impact of a non-zero sum of neutrino masses on the growth of structures. These measurements are sensitive to the behavior of neutrinos at cosmic distances, making them a perfect testbed for neutrino physics beyond the standard model at long ranges. In this talk, I will introduce a novel signal from long-range self-interactions between neutrinos. In the late-time universe, this interaction triggers the Jeans instability in the cosmic neutrino background. As a result, the cosmic neutrino background forms macroscopic bound states and induces large isocurvature perturbations in addition to the cold dark matter density perturbations. This enhancement of matter perturbation is uniquely probed by late-time cosmological observables. We find that with the minimum sum of neutrino masses measured by neutrino oscillation experiments, the current SDSS data already place strong constraints on the long-range neutrino self-interactions for interaction range greater than kpc.

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