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Warm dark matter cosmological structures - from collapse to caustics and cores

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Using cosmological simulations we explore the effects of warm dark matter (WDM) particles (e.g. sterile neutrinos) on the structure formation for different mass particles. Properties like the velocity dispersion and the damping of the fluctuation spectrum imprint a distinct signature on the structure formation mechanism as well as on the evolution of structures and on the internal structure of halos. Although the properties of the warm dark matter particles are strongly model dependent, we find that the structure formation mechanism is qualitatively more complex than originally assumed, a hybrid between top-down collapse and bottom-up growth. Comparing warm dark matter simulations with cold dark matter ones, we see that the internal structure of halos is also qualitatively different in these two cases. These effects and the differences between warm and cold dark matter can be tested with observations on both large scales and small scales. Finally we address some technical aspects in simulating warm dark matter.

Author: PADUROIU, Sinziana (University of Geneva)

Presenter: PADUROIU, Sinziana (University of Geneva)

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