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Sterile neutrinos as dark matter

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The discovery of neutrino masses suggests that the Standard Model should be supplemented with new gauge-singlet fermions, the sterile neutrinos. The number and the mass of sterile neutrinos are still undetermined. If one of these fermions has mass of several keV, it can account for the dark matter. Their relic abundance can be produced by several mechanisms. Different mechanisms result to "warmer" or "colder" dark matter that can explain the small-scale structure of the universe. If relic sterile neutrinos originate primarily from the decay of a scalar field at the electroweak scale, the resulting dark matter is much colder that the one produced in neutrino oscillations. This scalar field can be part of an extended Higgs sector, in which case it can also provide for a 1st order electroweak phase transition and yield observable signatures for accelerator experiments. The sterile-neutrino dark matter itself provides a potentially detectable signature from its two-body decay. The spectral line can be detected by X-ray telescopes. The same X-rays can speed up the formation of the first stars. A keV sterile neutrino can also give rise to the observed velocities of pulsars.

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