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Singlet-Doublet fermion dark matter, neutrino mass and collider signatures

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The galaxy rotation curve, gravitational lensing and the existence of large scale structure imply that the present Universe is filled with a mysterious form of invisible matter, called "dark matter (DM)", which is about 27% (roughly 5 times of visible matter) of the total energy budget. Hitherto the existence of DM has been consolidated via its gravitational interaction in a cosmological scale, starting from galaxy size. The main challenge at present is to probe the DM in a small scale, typically in an earth bound laboratory. The only information so far we know about DM is its relic density. However, the microscopic structure of DM is completely unknown. Unfortunately the standard model (SM) of particle physics, the best model that describes the fundamental interactions of visible matter, does not accommodate any such particle. In this talk we explore certain aspects of physics beyond the SM to include dark matter as well as non-zero neutrino mass confirmed by oscillation experiments. In particular, we extend the SM by including a light scalar triplet with hyper charge two and two vector-like fermions: one singlet and a doublet. A discrete symmetry is imposed on the additional vector-like fermions so that the dark matter arises as a mixture of the neutral component of the doublet and singlet. The scalar triplet acquires an induced vacuum expectation value after electroweak symmetry breaking and thereby inducing sub-eV masses to the neutrinos. We then obtain the parameter space satisfying relic density and to probe the model at collider.

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