

# Electroweak-charged Dark Matter and $SO(10)$ Unification with Parity Symmetry

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We consider electroweak-charged dark matter in an  $SO(10)$  unified theory that solves the strong  $CP$  problem via Parity. Electroweak-charged dark matter has a colored  $SO(10)$  partner, whose mass should be much above the dark matter mass to avoid cosmological problems arising from the decay of the colored partner. The mass hierarchy can be naturally achieved by an  $SO(10) \times CP$  symmetry breaking Higgs that has a missing vacuum expectation value. The mass hierarchy, via quantum corrections to the gauge coupling constants, lowers the unification scale and enhances the proton decay rate. Hyper-Kamiokande will probe the parameter space with precise gauge coupling unification. We derive the range of the top quark mass and the strong coupling constant preferred by radiative Parity breaking by the Higgs Parity mechanism.

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