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Baryon asymmetry from dark matter decay in the vicinity of a phase transition

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We propose a novel framework where baryon asymmetry of the universe can arise due to forbidden decay of dark matter (DM) enabled by finite-temperature effects in the vicinity of a first order phase transition (FOPT). In order to implement this novel cogenesis mechanism, we consider the extension of the standard model by one scalar doublet η, three right handed neutrinos (RHN), all odd under an unbroken Z_2 symmetry, popularly referred to as the scotogenic model of radiative neutrino mass. While the lightest RHN N_1 is the DM candidate and stable at zero temperature, there arises a temperature window prior to the nucleation temperature of the FOPT assisted by η, where N_1 can decay into η and leptons generating a non-zero lepton asymmetry which gets converted into baryon asymmetry subsequently by sphalerons. The requirement of successful cogenesis together with a first order electroweak phase transition not only keep the mass spectrum of new particles in sub-TeV ballpark within reach of collider experiments but also leads to observable stochastic gravitational wave spectrum which can be discovered in planned experiments like LISA.

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