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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 novelogenesis 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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