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A consistent model for leptogenesis, dark matter and the IceCube signal

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We discuss a left-right symmetric extension of the Standard Model in which the three additional right-handed neutrinos play a central role in explaining the baryon asymmetry of the Universe, the dark matter abundance and the ultra energetic signal detected by the IceCube experiment. The energy spectrum and neutrino flux measured by IceCube are ascribed to the decays of the lightest right-handed neutrino N_1, thus fixing its mass and lifetime, while the production of N_1 in the primordial thermal bath occurs via a freeze-in mechanism driven by the additional $SU(2)_R$ interactions. The constraints imposed by IceCube and the dark matter abundance allow nonetheless the heavier right-handed neutrinos to realize a standard type-I seesaw leptogenesis, with the $B-L$ asymmetry dominantly produced by the next-to-lightest neutrino N_2. Further consequences and predictions of the model are that: the N_1 production implies a specific power-law relation between the reheating temperature of the Universe and the vacuum expectation value of the $SU(2)_R$ triplet; leptogenesis imposes a lower bound on the reheating temperature of the Universe at 7×10^9 GeV. Additionally, the model requires a vanishing absolute neutrino mass scale $m_1 \simeq 0$.

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