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Constraints on the astrophysical flux and the dark matter decay with IceCube HESE data

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The IceCube detection of High Energy Starting Events (HESE) and the upward muon track events (6 year data) are presently hard to explain with the single power-law astophysical flux for energies above 30TeV. We investigate the possibility that a significant component of the additional neutrino flux originates due to the decay of a very heavy dark matter particle via several possible channels into standard model particles. We perform a full 4 parameter fit to IceCube data in which we vary astrophysical flux normalization, power-law index, dark matter mass, dark matter lifetime and dark matter decay mode. We show that that dark matter with mass in the PeV range and the lifetime around 10^27s provides much better fit to IC data than the best-fit astrophysical flux alone. We also find dark matter lifetime limits which are much stronger that those obtained from gamma-ray data for all channels except $b\bar{b}$, which is also disfavored by the IceCube HESE data.

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