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Constraints on Neutrino Secret Interactionsfrom Multi-messenger neutrinos scattering on CνB

We present new constraints on neutrino secret interactions (νSI) by studying high-energy neutrinos from well-known astrophysical sources, such as SN1987A, the blazars TXS $0506+056$ and PKS $0735+178$, NGC 1068 and KM3-230213A neutrino event. Our analysis focuses on Dirac neutrinos interacting with a massive spin-one boson as they propagate through the Cosmic Neutrino Background (CνB). We consider both ultra-relativistic and non-relativistic regimes, deriving bounds on the νSI coupling constant across the full mass range. Our results obtained using analytical methods, demonstrate significant constraints on the νSI coupling in the low-mass mediator mass region for a given cut-off parameter. With recently discovered KM3-230213A neutrino event we probe a new scale of the mediator mass.

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