

Secret coupling of neutrinos to a new light vector boson, Z_0 , with a mass smaller than 100 MeV is motivated within a myriad of scenarios which are designed to explain various anomalies in particle physics and cosmology. Due to longitudinal component of the massive vector boson, the rates of three body decay of charged mesons (M) such as the pion and the Kaon to light lepton plus neutrino and $Z_0(M \rightarrow l\nu Z_0)$ are enhanced by a factor of $(m_M/m_{Z_0})^2$; cf. with the famous $(m_l/m_M)^2$ chirality suppression in two body decay $M \rightarrow l\nu$.

The strongest bound comes from the $R_K \equiv \text{Br}(K \rightarrow e\nu)/\text{Br}(K \rightarrow \mu\nu)$ measurement in the NA62 experiment. The bound can be significantly improved by customized searches for signals of three body charged meson decay into the positron plus missing energy in the NA62 and/or PIENU data.