

## IceCube constraints on Violation of Equivalence Principle

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Among the information provided by high energy neutrinos, a promising possibility is to analyze the effects of a Violation of Equivalence Principle (VEP) on neutrino oscillations. We analyze the IceCube data on atmospheric neutrino fluxes under the assumption of a VEP and obtain updated constraints on the parameter space with the benchmark choice that neutrinos with different masses couple with different strengths to the gravitational field. In this case we find that the VEP parameters times the local gravitational potential at Earth can be constrained at the level of  $10^{-27}$ . We show that the constraints from atmospheric neutrinos strongly depend on the assumption that the neutrino eigenstates interacting diagonally with the gravitational field coincide with the mass eigenstates, which is not a priori justified: this is particularly clear in the case that the basis of diagonal gravitational interaction coincide with the flavor basis, which cannot be constrained by the observation of atmospheric neutrinos. Finally, we quantitatively study the effect of a VEP on the flavor composition of the astrophysical neutrinos, stressing again the interplay with the basis in which the VEP is diagonal: we find that for some choices of such basis the flavor ratio measured by IceCube can significantly change.

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