Title:	Signature of neutrino mass hierarchy in gravitational lensing
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Keywords:	Neutrino Gravitational Oscillations
Issue Date:	2020
Publisher:	American Physical Society
Citation:	Physical Review D, 102(2)
Abstract:	In flat spacetime, the vacuum neutrino flavor oscillations are known to be sensitive only to the difference between the squared masses, and not to the individual masses, of neutrinos. In this work, we show that the lensing of neutrinos induced by a gravitational source substantially modifies this standard picture and it gives rise to a novel contribution through which the oscillation probabilities also depend on the individual neutrino masses. A gravitating mass located between a source and a detector deflects the neutrinos in their journey, and at a detection point, neutrinos arriving through different paths can lead to the phenomenon of interference. The flavor transition probabilities computed in the presence of such interference depend on the individual masses of neutrinos whenever there is a nonzero path difference between the interfering neutrinos. We demonstrate this explicitly by considering an example of weak lensing induced by a Schwarzschild mass. Through the simplest two flavor case, we show that the oscillation probability in the presence of lensing is sensitive to the sign of Δm2=m22−m21, for nonmaximal mixing between two neutrinos, unlike in the case of standard vacuum oscillation in flat spacetime. Further, the probability itself oscillates with respect to the path difference and the frequency of such oscillations depends on the absolute mass scale m1 or m2. We also give results for realistic three flavor case and discuss various implications of gravitationally modified neutrino oscillations and means of observing them.
Description:	Only IISERM authors are available in the record.
URI:	https://journals.aps.org/prd/abstract/10.1103/PhysRevD.102.024043 (https://journals.aps.org/prd/abstract/10.1103/PhysRevD.102.024043) http://hdl.handle.net/123456789/3232 (http://hdl.handle.net/123456789/3232)
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