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Probing Neutrino Decay Using the First Steady-State Source of High-Energy Astrophysical Neutrinos, NGC 1068

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We use the recent discovery of the first steady-state source of high-energy astrophysical neutrinos by IceCube, NGC 1068, to probe the lifetime of neutrinos. By searching for specific features in the energy spectrum of neutrinos, we seek to detect the decay of neutrinos during their journey to Earth. Although the current event rates and uncertainties in the predicted neutrino flux from NGC 1068 limit our ability to identify novel physics signatures in the data and constrain the neutrino lifetime significantly, longer exposures and joint observations from upcoming neutrino telescopes and multi-messenger observations of NGC 1068 will improve our sensitivity to neutrino decay and other novel physics signatures. Furthermore, we demonstrate how we can use the flavour information of neutrinos inferred from the observation of cascade-like events from NGC 1068 in in-water neutrino detectors such as KM3NeT to establish more robust constraints on the neutrino lifetime, independently of the spectral shape of the neutrino flux emitted at the source.

In summary, the detection of high-energy astrophysical neutrinos from NGC 1068 provides a unique opportunity to probe the neutrino lifetime and investigate novel physics signatures. Our findings suggest that longer exposures and joint efforts with other telescopes will enable us to gain a deeper understanding of neutrino decay and other physics phenomena in the near future.

Submitted on behalf of a Collaboration?

No

Author: Mr VALERA BACA, Victor Branco (Niels Bohr Institute, University of Copenhagen)

Co-authors: FIORILLO, Damiano (Niels Bohr International Academy, Niels Bohr Institute,4 University of Copenhagen, 2100 Copenhagen, Denmark); ESTEBAN, Ivan (CCAPP, Ohio State University); Dr BUSTAMANTE, Mauricio (Niels Bohr Institute)

Presenter: Mr VALERA BACA, Victor Branco (Niels Bohr Institute, University of Copenhagen)

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