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Exploiting synergies between neutrino telescopes for the next galactic core-collapse supernova

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The core collapse supernova SN1987A was the first extra-galactic transient source ob- served in neutrinos, and 25 events detected by neutrino telescopes in the epoch marked the begin- ning of neutrino astronomy. Neutrino telescopes have not been able to make another supernova observation due to the remoteness of the sources. It is therefore essential to optimize the detection channel of sensitive detectors in case of an upcoming galactic core-collapse supernova. Relevant information on core-collapse supernova explosion can be extracted to study flavor evolution of neutrinos in dense environments. For certain massive supernovas, the magnetic field changes the accretion rate of matter and thus the production of neutrinos during the corresponding supernova explosion phase, but the way this accretion rate changes is not fully understood yet. In this contribution, we will present the potential of multi-detector analyses to enhance the scientific outputs from the next close-by core-collapse supernova by combining the expected light curves, neutrino detectors sensitive to different flavors such as in KM3NeT, DUNE, and DarkSide. We will study the constraints that could be set on the properties of the progenitor itself, such as its mass, as well as on the neutrino oscillation parameters. We will also present a study to better characterize the effect of magnetic field on neutrino observations by considering in particular the impact of dif- ferent magnetic field topologies on neutrino light curves for the KM3NeT, DUNE, and DarkSide experiments.

Summary

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