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IceCube Upgrade and -Gen2 - The future of neutrino astronomy at the South Pole

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The IceCube observatory at the South Pole, with its 1km3 of instrumented ice, is one of the largest neutrino detectors worldwide. The observatory has detected the first high-energy astrophysical neutrinos and has shown compelling evidence for the first neutrino point source. The success of IceCube has matured plans for the extension of its energy range of 10GeV to PeV towards both lower and higher energies. The first stage of this expansion is IceCube Upgrade, with a dense in-fill of seven additional strings to be deployed in the 2025/26 Antarctic summer season. The strings will be instrumented with around 700 novel optical sensors with increased sensitivity to detect low-energy neutrinos in the range of 1 to 100GeV. This will significantly enhance IceCube's capabilities to measure oscillation parameters and improve its already competitive results. Also, state-of-the-art calibration devices will be deployed, aiming to improve the current calibration of the IceCube detector, which will enhance the reconstruction of archival data taken in the last decade. A successful deployment of IceCube Upgrade will also pave the way for IceCube-Gen2, the next-generation high-energy neutrino telescope at the South Pole.

IceCube-Gen2 will enlarge the detector's volume to eight cubic kilometres increasing the detection rate of cosmic neutrinos by a factor of ten. The extension consists of three sub-arrays taking advantage of neutrino signals in the optical and radio range and a surface detector measuring atmospheric particle showers. This presentation will focus on the optical arrays of these extensions, addressing the R&D activities towards the Upgrade and Gen2 and the resulting physics potential.

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