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Spectral Sorting of Photons Using Dichroic Winston Cones

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Large-scale neutrino detectors typically observe photons created by interactions inside of the target volume. These detectors deploy a wide variety of technologies, most commonly water, ice, or scintillator targets surrounded by PMTs. The detected photons carry information that goes unused, most notably the wavelength, which can indicate the production method and travel time of the photon. In particular, in scintillator detectors, wavelength can be used to discriminate Cherenkov from scintillation light due to the broad wavelength distribution of Cherenkov light. This discrimination provides a method for reconstructing the direction of the events, which is crucial for identifying solar neutrino interactions. A novel method for sorting photons by their wavelengths is introduced using Winston cone concentrators made of dichroic filters. Using two or more different types of dichroic filters can provide valuable wavelength information with minimal photon loss.

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