Observing Neutrinos from UFOs

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Neutrinos are weakly interacting particles with virtually no mass or charge. Because of this, the path of this particle remains unhindered by things such as magnetic fields and other matter that may absorb or reflect other particles. Higher energy neutrinos reach us from black holes, supernovae, and other nuclear sources where cosmic rays are suspected to originate from (Francis & Klein 2010). Cosmic rays are of great interest to scientists; however, because they are made up of high-energy protons, electrons, and atomic nuclei, they interact very strongly with magnetic fields and matter. They are absorbed and reflected, and when those rays reach Earth's atmosphere, they get scattered. As a result, their origin cannot be pinpointed. Neutrino astronomy allows scientists to find these sources.

One place where neutrinos are observed is the IceCube observatory in the south pole. Using 5,160 sensors to send time-stamped, digitized waveforms of detected light to the surface, scientists can use the information to reconstruct neutrino events and infer the direction they arrived from and their energies (Francis & Klein 2010). In order to accomplish this, the sensors are not sensing the neutrino itself, but rather, they're observing the light produced by the neutrino interactions. The detector observes hundreds of neutrino interactions a day that are cataloged into different categories of events.

The research that will take place over the course of summer 2025 will use the sample of neutrinos in the "Ultra-Fast Outflows" catalog to determine if these sources produce cosmic rays. Ultra-fast outflows (UFO) are produced by active galactic nuclei (AGN). They are essentially powerful wide angle winds that, if sustained over time, can unbind the gas from the stellar centers of galaxies. These winds can interact with the interstellar medium, creating a shock similar to that of a supernova explosion that accelerates charged particles to higher energy levels (Ajello et al. 2021). This makes them a viable source of ultra-high energy particles and it has been proposed that protons can be accelerated up to a few exa-electronvolts when the UFOs come into contact with the stellar medium (Ehlert et al. 2025). These sources are most likely of hadronic origin, which means that they should produce neutrinos that can be observed.