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W.K.H. Panofsky Prize in Experimental Particle Physics (2021): The Ups and Downs of Atmospheric Neutrinos[1]

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Earth's atmosphere is bombarded by an isotropic flux of cosmic rays, primarily protons, which extend to very high energies. These primary cosmic rays interact with the components of the atmosphere and produce mesons, which in turn decay, to produce so called, atmospheric neutrinos. The first experiments to observe these neutrinos reported results in 1965. The detection was via the muons that are produced by the neutrino's nuclear interaction. The first hint of a discrepancy between the number of neutrinos expected and what was observed appeared in these results. The experimental situation remained controversial until the Super-Kamiokande experiment was built and reported data in 1998. The experiments large data samples made it possible to finely bin the events in energy and direction, which finally provided definitive proof of the deficit.

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