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High energy neutrino emission from a global accretion flow around a supermassive black hole based on a GRMHD simulation model

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The accretion flows around supermassive black holes would be a part of emission sources of the IceCube neutrinos. The effects of the global structure of the magnetized accretion flows on the neutrino SEDs are, however, still uncertain. We, therefore, carry out the calculation of SEDs of high energy neutrinos by using three dimensional general relativistic magnetohydrodynamic (GRMHD) simulation data of a radiatively inefficient accretion flow around a black hole. The time evolution of the cosmic-ray proton SEDs in the accretion flows are computed by using tracer particles, on which the Fokker-Planck equations are solved by assuming the turbulent acceleration and the effects of compressions. The high energy neutrino SEDs are calculated by taking into account the effects of pp collisions. We have found that the resulting neutrino SEDs becomes flatter than those of 1-zone models, attributed to a global structure effect, i.e., superposition of the various neutrino SEDs emitted at different positions. These moderately flat neutrino SEDs will be consistent with the diffuse neutrino SEDs observed by IceCube.

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