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A combined Flavour composition measurement of astrophysical neutrinos using multi-sample IceCube data

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IceCube, a cubic-kilometer Cherenkov Neutrino detector located at the South Pole has been able to put constraints on the diffuse astrophysical neutrino flavour ratio measured on Earth by establishing the existence of the astrophysical tau neutrino component of the neutrino flux. This measurement was made using the High Energy Starting Event (HESE) sample collected for over 7.5 years containing all-flavour, all-sky neutrino events with energies above 60 TeV. A dedicated particle identifier was used to reconstruct 'Double Cascade' event topologies, which are specific to tau neutrino charged current interactions. In this study, we present an updated measurement of the flavour composition using approximately 12 years of IceCube HESE data, applying a novel method of Monte-Carlo simulations to take detector systematics into consideration in a reliable and self consistent way. We show that this measurement delivers tighter constraints on the flavour composition of the astrophysical neutrino flux than previous IceCube analyses, especially when it is integrated in a combined fit with high statistics samples of through-going tracks and cascades.

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