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An Upper Bound for the Neutrino Flux From Jets of Active Galactic Nuclei

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We present a bottom-up calculation of the flux of ultra-high energy cosmic rays (UHECRs) and high-energy neutrinos produced by powerful jets of active galactic nuclei (AGNs).
By propagating test particles in 3D relativistic magnetohydrodynamic jet simulations, including a Monte Carlo treatment of sub-grid pitch-angle scattering and attenuation losses due to realistic photon fields, we study the spectrum and composition of the accelerated UHECRs and estimate the amount of neutrinos produced in such sources.
We find that UHECRs are not significantly affected by photodisintegration in AGN jets, consistent with Auger's detection of heavy elements at the highest energies.
Moreover, we present estimates and \emph{upper bounds} for the flux of high-energy neutrinos expected from AGNs.
In particular, we find that:
i) source neutrinos may account for a sizable fraction, or even dominate, the expected flux of cosmogenic neutrinos;
ii) neutrinos from the β-decay of secondary neutrons produced in nuclei photodisintegration may in principle contribute to the signal observed by IceCube, but can hardly account for all of it;
iii) since the most important background for UHECR−photons interactions is the AGN non-thermal emission, a picture arises where high-energy neutrino emission can correlate with AGN flaring activity.
We discuss our results in the light of multimessenger astronomy and current/future neutrino experiments.

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