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MULTI-MESSENGER SIGNATURES OF LOCAL RADIO GALAXIES AS POTENTIAL UHECRS SOURCES

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About a century ago, new windows into the Universe were opened with the detection of cosmic messengers beyond electromagnetic radiation. Ultra-high-energy cosmic rays (UHECRs), nuclei with energies above 10^{18} eV, are deflected by galactic and extragalactic magnetic fields, making it extremely difficult to trace them back to their sources. The Pierre Auger Observatory has been measuring the flux of these particles that reach Earth. Due to their powerful jets and extended radio lobes, radio galaxies appear to provide ideal environments for particle acceleration. Moreover, energy losses caused by interactions with background photon fields that permeate the Universe imply that the sources of UHECRs must be local. These interactions, such as pair production, photopion production, and photodisintegration, generate a wide range of secondary particles. Assuming that the three most prominent nearby radio galaxies: Centaurus A, Virgo A, and Fornax A, can explain the UHECR flux observed by the Pierre Auger Observatory, and that a fraction of their jet power is used to accelerate cosmic rays, we model the propagation of UHECRs through the extragalactic medium using a realistic spectrum for FRI galaxies. The main objective of this work is to evaluate the resulting flux of secondary particles, in particular — gamma rays and neutrinos — and to explore the prospects for their detection with current and future observatories such as the Cherenkov Telescope Array Observatory (CTAO), the Giant Radio Array for Neutrino Detection (GRAND), and Probe of Extreme Multi-Messenger Astrophysics (POEMMA) Observatory.