CONSTRAINTS ON COSMIC RAY PRODUCTION FROM BROAD-BAND OBSERVATIONS AND MODELING OF THE SUPERNOVA REMNANT G347.3-0.5

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The supernova remnant G347.3–0.5 emits a featureless power-law in X-rays, thought to indicate shock-acceleration of electrons to high energies. We here produce a broad-band spectrum of the bright NW limb of this source by combining radio observations from the Australia Telescope Compact Array (ATCA), X-ray observations from the Advanced Satellite for Cosmology and Astrophysics (ASCA), and TeV γ-ray observations from the CANGAROO imaging Čerenkov telescope. We assume this emission is produced by an electron population generated by diffusive shock acceleration at the remnant forward shock. The nonlinear aspects of the particle acceleration force a connection between the widely different wavelength bands and between the electrons and the unseen ions, presumably accelerated simultaneously with the electrons. This allows us to infer the relativistic proton spectrum and estimate ambient parameters such as the supernova explosion energy, magnetic field, matter density, and efficiency of the shock acceleration process. We find convincing evidence that the shock acceleration is efficient, placing $> 20\%$ of the shock kinetic energy flux into relativistic ions. However, we find that the maximum electron and proton energies depend somewhat on assumptions for the compression of the magnetic field in the shock, but are generally well below the observed 'knee' at $\sim 10^{15}$ eV in the galactic cosmic-ray spectrum. We discuss implications of this for theories of cosmic-ray origin.