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Radio and Gamma-Ray Constraints on the Wind, Magnetic Field, and Cosmic Rays along the minor axis of the starburst M82

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Cosmic rays can be probed by their non thermal emission in the radio and in gamma-ray bands. One-zone models of cosmic rays have been used to match the integrated emission of starburst galaxies. We construct multi-dimensional models of the local starburst M82 using cosmic ray propagation code GALPROP. Using the integrated gamma-ray and radio spectra, along with the vertical distribution of radio emission along the minor axis, we constrain the gas density, magnetic field strength, and cosmic ray population. We show that the wind velocity and diffusion coefficient can be constrained by the morphology of the radio halo. We discuss the interplay between gas density, magnetic field, and outflow velocity and how they effect the emission. We comment on the energetics of cosmic ray species in the system. We provide direct constraints on the dynamical importance of cosmic rays in driving the outflow of the galaxy.

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