From Electrons to Janskys: Synthetic Imaging of 3D Relativistic Jet Simulations

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I will present a suite of synthetic full Stokes synchrotron emission maps created via polarized radiative transfer through 3D relativistic jet simulations. In particular, I model the linear and circular polarized synchrotron emission emanating from three distinct numerical jet models: a relativistic Particle-in-Cell (PIC) jet simulation, a relativistic Magnetohyrdodynamic (RMHD) jet simulation, and the Turbulent Extreme Multi-Zone (TEMZ) model of blazar emission. The synthetic polarized emission maps of these jet models are created via ray-tracing and include the effects of optical depth, relativistic aberration, Faraday rotation, Faraday conversion, slow-light interpolation, and beam convolution. Direct comparison of these synthetic ray-traced images to mm-wave VLBI jet observations highlight the strengths (and weaknesses) in the ability of these various numerical schemes to capture the salient physics present in relativistic jets while also reproducing the observed synchrotron emission. I will also present a parallel study involving VLBI image stacking at 15 & 43 GHz (in Stokes I, Q, and U) aimed at discerning (through stacked RM analysis) the nature of the ambient medium (i.e. the Faraday screen(s)) surrounding blazar jets. These measurements will in turn be used to refine future relativistic jet simulations.