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Improved Electron Temperature Modeling for M87 Black Hole Imaging

The observation of the M87* black hole shadow has opened new avenues for exploring horizon-scale phenomena around astrophysical black holes.
Current interpretations of black hole images often rely on state-of-the-art general relativistic magnetohydrodynamics (GRMHD) simulations to model ion
temperatures, combined with post-processed radiative modeling of electron radiation. However, these approaches typically estimate the ratio between
ion and electron temperatures using assumed parameterizations based on parameters such as the local plasma beta, which may not fully capture the
underlying physics. To address this, we propose an alternative approach that estimates the electron temperature by considering inverse Compton
cooling (ICC) and Synchrotron cooling, allowing for a more accurate determination based on the local energy balance of electrons. We present a comparison of
electron temperatures and the resulting black hole images between the conventional parameterization and our new method, highlighting potential
improvements in modeling horizon-scale emission.

Blockquote

Section

High Energy

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