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Bridging Relativistic Jets from Black Hole Scales to Long-Term Electromagnetic Radiation Distances: a Moving-Mesh General Relativistic Hydrodynamics Code with HLLC Riemann Solver

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Relativistic jets accompany the collapse of massive stars, the merger of compact objects, or the accretion of gas in active galactic nuclei. They carry information about the central engine and generate electromagnetic radiation. No self-consistent simulations have been able to follow these jets from their birth at the black hole scale to the Newtonian dissipation phase, making the inference of central engine property through astronomical observations undetermined. We present the general relativistic moving-mesh framework to achieve the continuity of jet simulations throughout space and time. We implement the general relativistic extension for the moving-mesh relativistic hydrodynamic code - JET, and develop a tetrad formulation to utilize the HLLC Riemann solver in the general relativistic moving mesh code. The new framework is able to trace the radial movement of relativistic jets from central regions where strong gravity holds all the way to distances of jet dissipation.

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