PLASMA WAVES AROUND THE CENTRAL BLACK HOLE IN AN ACTIVE GALACTIC NUCLEUS

SEOK JAE PARK

Korea Astronomy Observatory

An axisymmetric, stationary electrodynamic model of the central engine in an active galactic nucleus has been well formulated by Macdonald and Thorne. The relativistic region around the central black hole is filled by plasma in this model. The propagation of the plasma waves which are parallel to the magnetic lines will be discussed in this presentation. The goal of this analyses will be to estimte the resonance, cut-off frequencies and to investigate the possibility of a significant energy transport.

Cosmological Hydrodynamic Code Based on the Total Variation Diminishing Schen

Dongsu Ryu

Chungnam National University, Department of astronomy and Space Science

We describe an explicit second order finite difference code based on a total variation diminishing scheme for self-gravitating cosmological hydrodynamic systems. The code has been developed to follow correctly the adiabatic changes of extremely supersonic preshock flows with a Mach number larger than 100 as well as very strong shocks. In highly supersonic regions, we utilize an entropy-like variable switching to a more conventional total energy variable near to and interior to shocks. The self-gravity has been included in such a way that the numerical errors in calculating the gravitational force term do not induce the leakage of the gravitational energy into the thermal energy of the gas. Also, the gravitational force term has been corrected to take account of the mass diffusion around the shocks so the total energy can be conserved. Tests for the accuracy and performance of the code without gravity have proven that it can accurately handle supersonic flows with a Mach number larger than 10^4. In calculations of the formation of an one dimensional Zel'dovich pancake, an energy accuracy of 1% is obtained for 32 cells per unit wavelength and the accuracy reaches 0.01% as the number of cells approaching 1024. To further test the code with gravity, three dimensional simulations of a purely baryonic universe but with the initial cold dark matter power-spectrum have been performed. The results have shown that shocks are well resolved and separete cleanly the hot, dense, collapsed peaks from the cold, low density, expanding voids. The thermal energy in low density regions can be orders of magnitude lower using this scheme than in some others due to very careful attention given to entropy in high Mach number regions.