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Extended Abstract

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Astronomical observational evidences of magnetic monopoles and its implication of astrophysics

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An anomaly strong radial magnetic field near the Galactic Center (GC) is detected. The lower limit of the radial magnetic field at r=0.12 pc from the GC is bmG. It's possible scientific significances are following: (1) The black hole model at the GC is incorrect. The reason is that radiations observed from the region neighbor of the GC are hardly emitted by the gas of accretion disk due to it being prevented from approaching to the GC by the abnormally strong radial magnetic field. (2) This is an anticipated signal for existence of Magnetic Monopoles (MM). The lower limit of the detected radial magnetic field is quantitatively in agreement with the prediction of our paper. An AGN model with MM. (3) Magnetic monopoles may play a key role in some very important astrophysical problems using the Robakov-Callen effect that nucleons may decay catalyzed by MM. Taking the RC effect as an energy source, we have proposed a unified model for various supernova explosion, including to solve the question of the energy source both in the earth core and in the white dwarfs and (4) We may explain the physical reason of the hot big bang of the universe with the similar mechanism of supernova explosion by using the RC effect as an energy source.

It is now generally believed that bright quasars observed at large red-shift are supermassive and rapidly spinning black holes formed in the primordial universe. The spectacularly huge luminosity is supplied by the black hole and the surrounding accretion disk. In such models, magnetic fields play a very important role. More specifically, the magnetic coupling between the central black hole (or some supermassive stellar object) and the accretion disk enable effective transport of energy and angular momentum between them. If the black hole spins faster than the disk, energy and angular momentum can be extracted from the black hole and transferred to the disk vie the pointing flux (Blandford and Payne 1982; Blandford and Znajek 1977; Yuan and Narayan 2014). It is now well established that the transfer of energy and angular momentum in such a rotating black hole and accretion disk system with magnetic coupling can generate relativistic jet by the mechanism of Blandford and Znajek (1977) if the energy source is the spinning black hole.

The accretion model of GC is hot accretion flow. One of the most important progress in this field is the finding of strong wind from black hole hot accretion flow. For example, reformulated the adiabatic inflow and outflow solution (ADIOS) model for radiatively inefficient accretion flows, treating the inflow and outflow zones on an equal footing. Narayan et al. (2012) presented the results from two long-duration general relativistic magneto-hydrodynamic (GRMHD) simulations of advection-dominated accretion around a non-spinning black hole. However, accretion onto a super-massive black hole of a rotating inflow is a particularly difficult problem to study because of the wide range of length scales involved. By using the ZEUS code, Li et al. (2013) run hydrodynamical simulations of rotating, axisymmetric accretion flows with Bremsstrahlung cooling, considering solutions for which the centrifugal balance radius significantly exceeds the Schwarzschild radius, with and without viscous angular momentum transport.

On the other hand, Hydrodynamical (HD) and magnetohydrodynamics (MHD) numerical simulations of hot accretion flows have indicated that the inflow accretion rate decreases inward. Two models have been proposed to explain this result. In the adiabatic inflow-outflow solution (ADIOS), this is because of the loss of gas in the outflow. In the alternative convection-dominated accretion flow model, it is thought that the flow is convectively unstable and gas is locked in convective eddies. Some authors have discuss detaily these problems (e.g., Yuan et al. 2012, 2015; Bu et al. 2013). Based on the no-outflow assumption, Gu (2015) investigated steady-state, axisymmetric, optically thin accretion flows in spherical coordinates. By comparing the vertically integrated advective cooling rate with the viscous heating rate, They found that the former is generally less than 30 % of the latter, which indicates that the advective cooling itself cannot balance the viscous heating. The existence of magnetic monopoles is predicted by many theories of particle physics beyond the standard model. However, in spite of extensive searches, there is no experimental or observational sign of them. I review the role of magnetic monopoles in quantum field theory and discuss their implications for particle physics and cosmology. I also highlight their differences and similarities with monopoles found in frustrated magnetic systems.

Experience tells us that magnetic north and south poles cannot be separated into magnetic monopoles, i.e. isolated magnetic charges.

Bottom Note: *This work is partly presented at* International conference on Atomic, Nuclear and Plasma Physics , November 19-20, 2018, Sydney, Australia