

Neutrino transport in accretion disks

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Gamma-ray bursts (GRBs) are one of the most violent explosions in our universe. Even though the fireball-shock model succeeds in explaining the multi-wavelength emission from the afterglow of GRBs, we have not known what is the central engine of GRBs. The generally accepted model for the central engine of GRBs is believed to be related to the hyperaccretion of a stellar-mass black hole at extremely high rates, such as one solar mass per second! In such an accretion disk, matter is so dense that photons are trapped. The possible channel for energy release is neutrino emission, so this model is so-called Neutrino-Dominated Accretion Flow (NDAF).

In this talk, I will give a brief introduction to our recent works on neutrino/anti-neutrino transport in NDAF, its influence on the dynamics of NDAF and the luminosity of neutrino annihilation. Our main concern is to check whether the released energy could power the fireball. We find that the annihilation luminosity is sensitive to the accretion rate and will be not sufficient to power the fireball of most energetic GRBs if the accretion rate is lower than 1 solar mass per second. Therefore, the effects of the spin of the black hole or/and the magnetic field in the accretion flow might play a role in powering the central engine of GRBs.

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