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Black hole hyperaccretion disks and gamma-ray bursts

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Gamma-ray bursts (GRBs) are the most luminous explosions in the Universe, and their origin and mechanism are the focus of intense research and debate. Black hole hyperaccretion model is one of the plausible candidates for the central engine of gamma-ray bursts and their activity is supposed to result in the complicated explosion phenomena including gamma-ray bursts, gravitational waves, and their electromagnetic counterparts. In the inner regions of such disks, photons are totally trapped due to high density and temperature. Getting cool through neutrinos and antineutrinos efficiently, these accretion disks are also called Neutrino Dominated Accretion Flows (NDAFs). Moreover, the high magnetic field (~ 10^15−16G) and large density (~ 10^10g cm−3) can be considered as the two important physical features of these disks, and as a result, self-gravity and gravitational instability might be of a crucial role in these dense hyperaccretion flows. As well, the magnetic field is proposed to be of considerable importance via both large and small scale impacts. After providing an introduction to the GRB's and the candidates of their central engines, we focus on these two factors (self-gravity and magnetic field) to probe their potential effects on the hyperaccretion disk's structure, in addition to their subsequent impacts on the GRB's spectral features. In other words, we apply these two features to provide an explanation for the prompt Gamma-ray emission with its highly variable structure in the early time, and the electromagnetic afterglow emission associated with the late time activity of the GRB's central engine.

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