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Probing the Peculiar Behavior of GRS 1915+105 at Super-Eddington Luminosity

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GRS 1915+105 is one of the best objects in our Galaxy for the study of super-critical accretion. Its mass accretion rate has been persistently close to or higher than the Eddington limit for more than two decades. The constraint on the mass from the dynamical estimation helps us to study the detailed relation between the X-ray spectra and mass accretion rate in terms of its luminosity. For this purpose, we use RXTE data to study the X-ray spectra of GRS 1915+105 systematically by applying the disk+corona model. Given the luminosity range of the data, $\sim 0.4L_{\rm E}$ – $1.3L_{\rm E}$, we chose the extended disk blackbody model (so-called p-free disk model) to fit the disk component, assuming an effective temperature profile, $T_{\rm eff} \propto r^{-p}$, where r is the disk radius. As for the corona, we chose thermal Comptonization model. We take into account the H-like iron absorption lines at 7 keV and an edge at 9.0 keV. We found that our data follow $L \propto T^4$ track as in the standard disk case. However, we found not only one but two different $L \propto T^4$ tracks, separating the data with $L \gtrsim 0.6L_{\rm E}$ from those with $L \lesssim 0.6L_{\rm E}$. The fact that the former seems have lower disk temperature adds more challenge to the theoretical prediction.