W39a The role of the nuclear equation of state on Type-I X-ray burst models

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Near the surface of an accreting neutron star, the Type-I X-ray burst, which is the thermonuclear explosion induced by the unstable burning of light nuclei, is known to occur. More than 100 bursters have been observed so far (Galloway et al., 2020). The light curve is characterized by several parameters, e.g., recurrence time, peak luminosity, and burst duration. Many numerical simulations to examine their parameters have been performed (e.g., Woosley et al., 2004, Heger et al., 2007, Fisker et al., 2008, Meisel 2018, Meisel et al., 2019, Johnston et al., 2020), focusing on the effect of the nucleosynthesis (e.g., rp-process). However, these calculations only cover the accreted layer and the micro physical effects inside the neutron star such as the equation of state (EOS), neutrino Urca processes occurring in the core, are not considered.

In this presentation, we focus on the EOS dependence on X-ray burst light curves. The neutron-star EOS affects the parameters to characterize light curves mainly because the ignition condition of the H or He layer is determined through the surface gravity when considered in the simple plane-parallel model (Fujimoto et al. 1981). So, numerical simulations for the whole neutron star are needed to describe the light curves exactly. In this work, we calculate the burst light curves using a general relativistic evolutionary code (Fujimoto et al. 1984) with an adaptive nuclear reaction network with 88 nuclei. Based on the calculations, we will show the relationship between EOS and some characteristic parameters of light curves in outburst.