Contribution ID: **8** Type: **not specified**

Dark Matter Heating vs. Rotochemical Heating in Old Neutron Stars

Thursday, 5 December 2019 09:00 (1 hour)

Dark matter (DM) particles in the Universe accumulate in neutron stars (NSs) through their interactions with ordinary matter. It has been known that their annihilation inside the NS core causes late-time heating, with which the surface temperature becomes a constant value of 2000-3000 K for the NS age t > 10^6-10^7 years. This conclusion is, however, drawn based on the assumption that the beta equilibrium is maintained in NSs throughout their life, which turns out to be invalid for rotating pulsars. The slowdown in the pulsar rotation drives the NS matter out of beta equilibrium, and the resultant imbalance in chemical potentials induces late-time heating, dubbed as rotochemical heating. This effect can heat a NS up to 10^6 K for t > 10^6–10^7 years. In fact, recent observations found several old NSs whose surface temperature is much higher than the prediction of the standard cooling scenario and is consistent with the rotochemical heating. Motivated by these observations, we reevaluate the significance of the DM heating in NSs, including the effect of the rotochemical heating. We show that the signature of DM heating can still be detected in old ordinary pulsars, while it is concealed by the rotochemical heating for old millisecond pulsars. On the other hand, a discovery of a very cold NS can give a robust constraint on the DM heating, and thus on DM models.

Presenter: HAMAGUCHI, Koichi (University of Tokyo)

Session Classification: Morning session