[JJ] Evening Poster | P (Space and Planetary Sciences) | P-PS Planetary Sciences

[P-PS08]Planetary Sciences

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Sun. May 20, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
We call for general interest papers for Planetary Sciences. Planetary Sciences consist of a variety of studies on the past, present, and future of our solar system and exoplanetary systems. Discussions based on various backgrounds are encouraged.

[PPS08-P13]Temperature Structure of Weakly-Ionized Protoplanetary Disks

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Keywords:Protoplanetary disks, Magnetohydrodynamics, Temperature structure

The temperature profile of protoplanetary disks is a key parameter to understand planet formation. Accretion heating determines the gas temperature of inner protoplanetary disks in early evolutionary stage. The conventional temperature model is based on the classical accretion heating model where the Shakura-Sunyaev alpha parameter is vertically constant. However, magnetohydrodynamic (MHD) simulations showed that vertical profile of the alpha parameter depends on MHD effects. We investigate the vertical temperature profile in protoplanetary disks whose dynamics is controlled by magnetic fields with the effects of partial ionization. We find that for our fiducial disk model, Joule heating occurs at three scale heights above the midplane due to the large ambipolar diffusion at the midplane. The absence of Joule heating near the midplane leads to the midplane temperature significantly lower than the temperature determined by stellar irradiation. Our parameter study shows that in most cases, the classical accretion heating model significantly overestimates the midplane temperature. Our results suggest that the midplane temperature in disks' inner region is determined by irradiation heating rather than accretion heating in early stage of disk evolution.