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[Ne II] and X-ray emission from ρ Ophiuchi young stellar objects

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Circumstellar disks are mostly made of gas. Constraining the spatial and thermal structure of the gas, and its time evolution, is crucial to understand the star- and planet-formation processes. Models predict that the gas is affected by UV and X-ray radiation from the central young stellar object (YSO), but many uncertainties remain, e.g. whether the EUV emission actually reaches the disk or is absorbed by disk winds. The infrared [Ne II] and [Ne III] fine structure lines at 12.81μm and 15.55μm have been theoretically predicted to trace the circumstellar disk gas subject to X-ray heating and ionization.

Flaccomio *et al.* (2009, A&A, arXiv:0906.4700) present observational results for a sample of 28 YSOs in the ρ Ophiuchi star formation region for which good quality infrared spectra and X-ray data have been obtained, the former with the Spitzer IRS and the latter with the Deep Rho Ophiuchi XMM-Newton Observation (DROXO). The [Ne II] and the [Ne III] lines are detected in 10 and 1 cases, respectively. In Figure 1 we plot the [Ne II] line luminosities vs. X-ray luminosity and accretion rate. No correlation with X-ray emission is observed. The luminosity of the [Ne II] line for one star, and that of both the [Ne II] and [Ne III] lines for another one, match the predictions of published models of X-ray irradiated disks; for the remaining 8 objects they are 1-2 dex higher than predicted on the basis of their $L_{\rm X}$. Class I YSOs have significantly higher [Ne II] luminosities with respect to Class II objects. The [Ne II] line correlates with mass accretion rate. These results might point toward a role of accretion-generated UV emission in exciting the disk gas, or to [Ne II] emission in shocks within accretion-powered winds and jets.

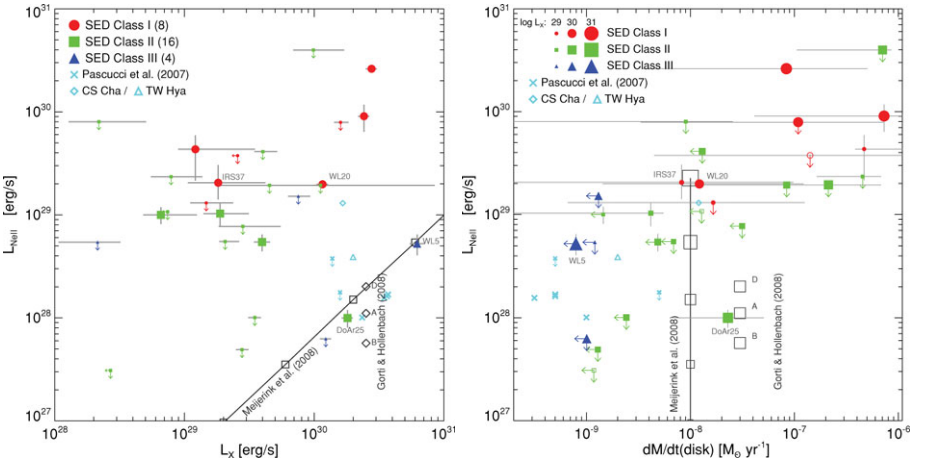

Figure 1. [Ne II] luminosity vs. $L_{\rm X}$ and $\dot{M}_{\rm disk}$. Class I, II, and III objects are indicated with different symbols. In the right-hand panel symbol sizes are proportional to $\log L_{\rm X}$. Also plotted here are 8 T-Tauri stars from Pascucci *et al.* (2007, ApJ, 663, 383) and Espaillat *et al.* (2007, ApJ, 664, L111) (CS Cha and TW Hya) and the model predictions of Meijerink *et al.* (2008, ApJ, 676, 518) and Gorti & Hollenbach (2008, ApJ, 683,287, models 'A', 'B', and 'D').