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This paper reports on the firm detection of Ne^+ and H(7-6) infrared emission lines in several protoplanetary disks around young stars. The origin of Ne ions is attributed to the strong high-energy radiation typical of young active stars. Thus, these observations open up the possibility of investigating in detail the dominant ionization mechanism (X-rays, EUV) in disk atmospheres. On the other hand, the H(7-6) emission is claimed to trace the accretion shock region and/or stellar corona and therefore might be useful to study disk-star interaction.

To my mind, this paper does contain significant new results and definitely deserves publication in ApJ. The paper is well-written and concise. However, before making my final recommendations, I would like to ask authors to consider my comments listed below. I use the notation /.../ to indicate relatively minor suggested changes, while the others are more important.

p.1, Abstract:

/After sentence 5: I would add a sentence here about possible correlations between L_[NeII] and L_X, M_dot./

Last s.: To my mind, this phrase is contradictory. There'll always be a certain amount of ionized Ne atoms in the disks around active young stars, but C+ seems to be more reliable tracer of the total gas mass (it'll become detectable at ~150 mum with Herschel). Following the conclusions of the manuscript, the fine-structure NeII emission lines are good tracers of the stellar high-energy radiation field and gas kinematics of the upper disk atmosphere (at sufficiently high spectral resolution).

ANSWER: We modified the last sentence as follows:
"Because the observed [Ne ii] emission probes very small amounts of gas in the disk surface (~ 10^{-6} MJ) we suggest using this gas line to trace the presence or absence of gas in more evolved circumstellar disks. "

Because NeII emission requires small column densities, it can be used as a probe for the presence or absence of small amounts of gas in evolved disks (when the stellar high-energy radiation is comparable to that in young pre-main-squence stars). The referee is right that Ne cannot trace the total gas mass but can tell us whether there is at least ~ 10^{-6} MJ of gas in the disk. The re-phrasing of the last sentence of the Abstract should better describe the possible use of this gas tracer. It is true that C+ probes larger gas masses in the disks in comparison to Ne+ but right because of this will provide less stringent constraints on the absence of gas in more evolved dissipating disks (it takes more mass to produce detectable C+ emission than Ne+ emission).

p.2, Introduction:

paragraph 2, s.2, s.4: Could you add a couple of refs here? E.q., from Protostars & Planets V?

ANSWER: We included more references in paragraph 2

/par.2, s.4: Could this phrase be re-written more clearly? It leaves an impression that we know a lot about dust content of the disks, and not so much about properties of the disk gas, which is not totally true (see, e.g. recent papers by Pietu et al.)./

ANSWER: We changed the sentence to "less well characterized".
The paper by Pietu et al. 2007 present a detailed analysis of the structure of three disks based on gas traces. Although these gas disks are well studied, such detailed analysis cannot be yet extended to a large sample of disks. Detecting gas lines, especially in more evolved disks, is more challenging than detecting continuum emission from dust. In this respect the properties and evolution of circumstellar gas are less well characterized than the properties and evolution of circumstellar dust.

par.3, s.2: the word "constraining" is not necessary.

ANSWER: Removed

par.4, s.4: A reference to the paper by Glassgold, Najita & Igea should be updated as this article has been recently published in ApJ.

ANSWER: Corrected

par.4, last s.: I have the same criticism as for the last phrase in Abstract.

ANSWER: Sentence changed as in the Abstract. New sentence:
"Since both models find that the Neii line probes small amounts of gas on the surface of circumstellar disks, we also suggest using this tracer to place stringent constraints on the presence or absence of gas in more evolved disks."

p.3:

/Table 1: This Table has a block of comments that is larger than the table itself. Would it be possible to move b) notes in Sect.2? I would also put 6 column in the very end of the table./

ANSWER: We moved note b in Sect.2. We prefer to keep the ages of the sources in col 6 (instead of moving them at the very end of the table) because the reference column is relevant to the distances and ages (not to Teff and Av).

Table 1: It will be clearer for the reader to see all uncertainties put in the table, not in the extended comments below. As one reads from the last sentence of the note b), the uncertainties due to the stellar activity can be higher that the values reported in the last column. Would it be less misleading to use an upper limit of 0.2 dex there?

ANSWER: We added the uncertainties in the Table. Depending on the source properties the stellar activity can result in Lx variations of less than 0.2 dex or more than 0.2 dex so we believe that it is more misleading to give 0.2 dex as an upper limit to the error in Lx.

/p.4, Sect.2, s.5-6: Later in the text you refer to low MIR excess that allowed to detect the neon IR lines in these 4 objects. Can you say here a bit more about their SEDs? Do they show evidence for inner holes or grain growth/evolution?

ANSWER: We included some details in Sect. 2 and the reference to Bouwman et al. 2007 for their dust/disk evolutionary stage. Among our 6 sources, only one (RX1852) has an SED resembling that of transition disks like GMAur suggestive of a large inner hole (Sect. 4).

p.5, Sect.2.1, par.1: Please add a sentence about achieved spectral resolution, covered sky area by the spectrometer, and the signal-to-noise ratios for the lines. May be one can put it in Table 2.

ANSWER: We included these information in Sect. 2.1

p.7, Sect. 2.2: Have the spectrum of PDS 66 been also observed and analyzed? If not, please add an explanation here.

!!!TODO!!!!

p.8, Figs. 1-2: It is hard to distinguish between the modeled profiles when these Figures are plotted in grayscale. Could you modify a bit the line styles and colors?

ANSWER: We used thicker lines for the gaussian fits and thinner lines for the observed spectra. The profiles are now distinguishable in grayscale.

/p.9, Fig. 2: What is the signal-to-noise for an apparently tentatively detected [NeIII] line in the case of RXJ1852?/

ANSWER: The [NeIII] emission would be only a ~1.4 sigma detection that's why we prefer not to mention it. Longer exposures are necessary to determine whether the line is real.

p.11, Sect. 3.1: I wonder if the line shapes can be used to extract some information about the [NeII] formation zone in the disks. As it appears in Fig. 1, the neon line on each spectra consists of several spectral channels. Are these bins real? In a PPD around a Sun-like star an emission region starting at 0.1 AU should produce an emission line with the ~500 km/s line width, which is about 0.015 mum at the wavelength of 12.81 mum. I think it will be interesting to discuss this point somewhere in the paper, presumably in this Section.

ANSWER : There are two pixels contained within the projected width of the entrance slit, that is what is visible in the figures, in other words we did not rebin the data to the actual resolution (2 pixels). The detected lines are unresolved as mentioned in Sect. 3.1 (the resolution of the high-res IRS is ~460km/s or 0.015um at 12.81um) thus we cannot use the line shape to constrain the NeII emitting region. In addition, to get information on the emitting zone from the line shapes one would need high signal-to-noise spectra (which is not the case of our detections) so that there is enough flux also at the wings of the line.

p.12, Sect. 3.2, par.2, s.3: The adopted stellar effective temperatures are different in Tables 1 and 4, particularly for HD 143006. It would be more appropriate to give these values only once, otherwise it is somewhat misleading.

ANSWER : The Teff in Table 4 were rounded values of those in Table 1. We removed the entry in Table 4 as suggested.

/p.13, par.1, s.2: One may want to add a phrase about M_dot derived for clusters of different ages (see, e.g. Sicilia-Aguilar et al. (2007)./

p.14, Table 4: Could you add the M_dot and HI flux uncertainties in dex in this table?

ANSWER : We included the uncertainties in the table note.

p.16:

Sect. 4, par.1, s.2: Please update the reference to Glassgold et al.

ANSWER : done

/Last s.: Since the mass accretion rate depends on the stellar mass for the young PMS stars having the mass of <=1 M_sun (see, e.g. Padoan et al. 2005), there might also be a correlation between L_[NeII] and M_*. Do you find such a correlation for your observations? If yes, it would be nice to add it in Sect.4./

ANSWER : We plotted the Lneii vs Mstar but we did not find a correlation between the two quantities. This is not surprising when looking at the observational trend between Mdot and Mstar, e.g. Luhman et al. 2007, PPV, Fig. 6. Such correlation becomes evident only for a large range in masses, e.g. 0.1-3Msun. Our 6 FEPS sources span a small range in masses ~1.-1.8 Msun (see below for individual masses). There is a large scatter (more than an order of magnitude) in Mdot for such a narrow range in masses, and we have only a few sources. So a correlation between Lneii and Mdot does not necessarily imply a correlation between Lneii and Mstar.

RX J1111.7-7620 : 1.49 Msun -- PDS 66 : 1.17 Msun -- HD143006 : 1.27 Msun -- [PZ99] : 1.83 Msun -- RX1842 : 1.23 Msun -- RX1852 : 1.08 Msun

NOTE: These masses are computed from the Teff and Lstar in Table 1 using the tracks from Seiss et al. 1997.

p.17, Fig.4: Please add a note explaining which start corresponds to what index.

ANSWER : We added the following sentence "The numbers correspond to the ID numbers of our targets as given in Table 1."

p.18, par.1, last s.: Do the estimated mass accretion rates correlate with the weakness of the MIR excess?

ANSWER : We plotted the Mdot versus the MIR excess but we do not find any correlation: note that sources 1,3, and 6 have the same Mdot (Table 4) but very different MIR excess (Fig. 4). A different disk structure, for instance a different disk inner radius or different flaring, can affect more the MIR flux than a different Mdot. For example the D'Alessio et al. disk models predict only a ~10% increase in the MIR flux when a TTS disk accrete with Log(Mdot)=-8 rather than with Log(Mdot)=-9: this is because most of the accretion energy is re-emitted in the NIR rather than in the MIR.

p.19, Fig.5: Where are the L_[NeII] flux error bars that are plotted in Fig.4?

ANSWER : We included the errorbars in Fig. 5

p.20:

/par.1: How much do the distance uncertainties affect the L_X for the stars?/

ANSWER : Our uncertainties on Lx include the uncertainties on the source distance (as well as the uncertainties on the count rates and hardness ratios). An error on the distance of 10pc increases the uncertainty on Log (Lx) by ~ 0.02 dex for our sources. Therefore the largest source of uncertainty in Lx as given in Tab. 1 comes from the uncertainties on the count rates and hardness ratios.

p.24, Sect. 4.1:

par.1, s.1: Please correct the Glassgold et al. reference.

ANSWER : done

par.4: Could you briefly describe your model? The reader can easily consult the assumptions and result of Glassgold et al. (2007), while your modeling scheme is not presented.

ANSWER : We modified the text and included more details on the model. However we prefer to keep the text brief in this observational paper and refer the reader to the Hollenbach & Gorti theoretical paper (which is close to submission) for a complete and clear description of the EUV model.

p.26:

last s. of par.1: Have you tried to find a correlation between x(Ne+)/x(Ne) for the case when EUV is the dominant ionization source for the Ne atoms? A quick and simple estimate would be like that. EUV radiation will create a HII-like region, where the ionization degree is high, x_e>0.1. Consequently, it remains nearly constant even if L_EUV is significantly increased, leading to the ratio of x(Ne+)/x(Ne) that is directly proportional to L_EUV (or [L_X]^p, if it is a source producing EUV photons). It would be interesting to verify in the future which of these trends allow to explain the derived correlation between L_[NeII] and L_X.

ANSWER : The EUV maintains a completely ionized HII surface on the disk, where the neon is essentially completely ionized. If the EUV spectrum is soft, most of the neon is Ne+ (if it is hard, most of the neon is Ne++). The line luminosity is directly proportional to the volume emission measure of the HII gas if the critical density of the species is higher than the electron density (this is true for all collisionally excited lines from the dominant ionization level of a species in an HII region). Assuming a soft EUV spectrum most of the Ne is Ne+ and the [NeII] emission typically comes from gas with electron density ~ 10^4 – –10^5 cm^(-3), which is less than the [NeII] critical electron density of about 6 × 10^5 cm^(–3). The volume emissivity of an HII region is directly proportional to the absorbed EUV luminosity. Thus, [NeII] luminosity is predicted to be directly proportional to L_EUV.

§2: You discuss an apparent negative correlation between M_dot and L_[NeII]. Is it not an observational bias? As you stated in the paper, a weak MIR continuum is needed to allow firm detection of the neon line at 12.81 mum. For higher M_dot the efficiency of the mass transport onto the star is higher, which may also imply that there should be more warm dust producing higher MIR excess and thus less prominent neon line features.

ANSWER : As mentioned in the answer to the question on pg. 18, we do not find a correlation between Mdot and the MIR excess in our dataset.

Therefore the apparent negative correlation between Mdot and LNeII does not seem to be an observational bias. The disk models of D'Alessio et al. do not predict much higher MIR flux (only ~10% higher flux) when Mdot increases of an order of magnitude (from Log(Mdot)=-9). Note there is only a factor of 3 between the Mdot of our sources (Table 4), therefore changes in the MIR flux purely due to differences in accretion rates should be minimal.

§3: The disk flaring might be not that important if one assumes that the stellar X-ray radiation is produced at certain distance above the photosphere (e.g., >~10 stellar radii (~0.1 AU) due to coronal loop reconnection, see Glassgold et al. 1997). In a favorable geometrical case when it is located just
above the disk, and the [NeII] emitting region is small, the luminosity of the neon line won't that sensitive to the disk flaring.

ANSWER : Glassgold, Najita & Igea 2007 mention at the end of their paper that disk flaring can affect the NeII luminosity because it affects the X-ray attenuation (one but last paragraph of their paper). However, the referee is right that this might depend on the precise location of the NeII emitting region and certainly more modeling is necessary to characterize the dependence of Lneii on the disk flaring.

p. 27, Sect.5:

/par.2: see my comment about the line widths above./

par.3, s.2: What are the predicted sizes and location of the [NeII] emitting region?

ANSWER: Both the X-ray and EUV models predict that NeII emission arises within about 10-20AU from the star (see Sect. 4.1 where models are briefly described). That's why even high resolution spectroscopy of NeII lines cannot distinguish between the two models.

/p.28, s.5: As above, I would be more careful saying that the fine-structure neon lines can be used to constrain the gas mass upper limits in evolved disks./

References: Please, browse through and correct citations to those papers that has been recently published or accepted or put on astro-ph. E.g., Bouvier et al.; Bouwman et al. 2007; Glassgold et al. (2007); Gorti & Hollenbach (2007); Herczeg et al. (2007); Meyer et al. (2006); Natta et al. (2007).

ANSWER: We corrected the citations