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Chasing disk dispersal indicators: the origin of the [OI] low-velocity components from young stars

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Abstract. Understanding how a disk surrounding a young star evolves and disperses is crucial in order to understand the subsequent planet formation. In this proceeding, we summarize the results reported by Rigliaco *et al.* (2013) on the origin of the [OI] low-velocity component as a possible disk dispersal indicator.

Keywords. accretion, accretion disks – stars: formation – planetary systems:protoplanetary disks – stars: pre–main-sequence – ultraviolet:stars

1. Introduction

Formation of planets around stars are strongly influenced by how circumstellar disks disperse. The more efficient mechanisms known so far in order to disperse protoplanetary disks are viscous evolution (accretion of matter onto the central star) and photoevaporation. These two processes need to operate concurrently in order to explain disk lifetimes (Gorti *et al.* 2011, Owen *et al.* 2010). While viscous evolution produces several observables that can be used to estimate the rate at which the star is accreting (Alcalá *et al.* 2013 for a review), just a couple of wind tracers are known so far. The low-velocity component (LVC) of the [NeII] line at 12.81μm has been found to trace a photevaporative disk wind driven by stellar X-rays/EUV photons (Pascucci & Sterzik 2009, Sacco *et al.* 2012, Baldovin-Saavedra *et al.* 2012, Hollenbach & Gorti 2009, Ercolano & Owen 2010). Another diagnostic of disk wind is the CO ro-vibrational band at 4.7μm. This emission line, ubiquitous around young stars surrounded by disks, has been interpreted as arising in a slow disk wind (Pontoppidan *et al.* 2011, Bast *et al.* 2011, Brown *et al.* 2013). In the following sections we will discuss the [OI] LVC as a possible disk dispersal tracer.

2. Results

We have collected a sample of 8 T Tauri stars with high-resolution optical spectra, and with at least a detection of the [NeII] line and/or the CO line. We have compared the [OI]-LVC profile with the [NeII] and the CO line profiles, and we find that these lines have different profiles, suggesting that they are arising from different regions around the stars (Rigliaco *et al.* 2013). In order to compare the properties of the [OI]-LVC with the stellar properties (e.g. masses, luminosities, accretion luminosities), we have re-analyzed the comprehensive survey of T Tauri stars in Taurus done by Hartigan *et al.* (1995).

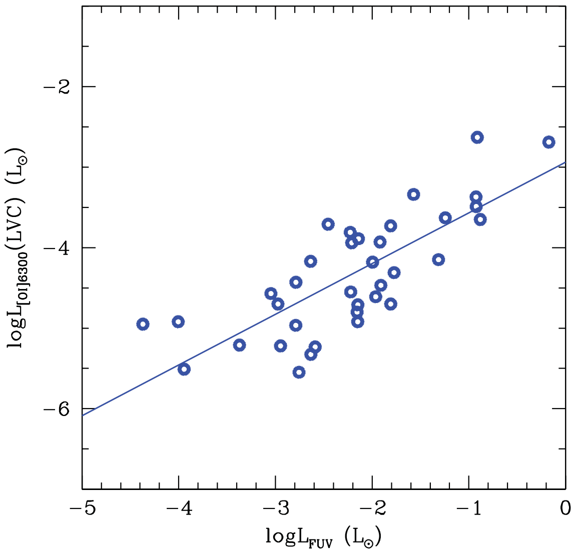

Figure 1. [OI] LVC luminosity versus FUV luminosity. The $L_{[OI]LVC}$ – L_{FUV} relation is $LogL_{[OI]LVC}$=(0.63 ± 0.09)×$LogL_{FUV}$ - (2.94 ± 0.21). The FUV luminosities come from Yang *et al.* 2012.

We find that there is a clear trend of increasing [OI]-LVC luminosities for increasing FUV luminosities (see Fig. 1 and Rigliaco *et al.* 2013). This trend, together with the low [OI]6300Å/[OI]5577Åline ratio (Rigliaco *et al.* 2013) suggests that the [OI]-LVC is tracing the disk layer which is heated by the FUV photons coming from the central star. These FUV photons penetrate the outflow columns of classical T Tauri stars and reach the disk surface where they dissociate the OH molecules producing the oxygen atoms in the ^1D and ^1S states. Once that these atoms decay to the ground state they produce the observed [OI]6300Åand [OI]5577Ålines. From the analysis of the higher resolution and signal-to-noise spectra it is possible to distinguish two different component of the LVC. A bound component of gas in Keplerian rotation, and an unbound component produced by gas at radial distances >10AU, likely a photoevaporative wind (see Rigliaco *et al.* 2013).

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