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Line surveys of irradiated protostars: Photo-destruction and evaporation

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Abstract. Submillimetre observations of the externally irradiated protostar R CrA IRS7B show that this source has dramatically different chemical abundances in comparison with otherwise similar embedded protostars not subject to external irradiation.

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We have performed observations of the externally irradiated protostar R CrA IRS7B using the APEX and ASTE telescopes. The protostar is irradiated by the Herbig Be star R CrA, which enhances the kinetic temperature (traced by the H_2CO rotational temperature) in the envelope to $\sim$ 40 K (Lindberg & Jørgensen 2012). The abundance of CH_3OH is about two orders of magnitude lower than what is found in the so-called *hot corino* protostar IRAS 16293-2422 (Cazaux *et al.* 2003), a source with similar mass and age. Several complex organic molecules are also found to have very low abundances, even with respect to the under-abundant CH_3OH (Lindberg *et al.* 2015). This can be explained by the elevated temperatures leading to evaporation of CO from the grain surfaces, in turn inhibiting the formation of organics on the grain surfaces.

On the other hand, the abundance of the photo-destruction product CN is significantly enhanced. Likely, the irradiation from R CrA causes photo-destruction in the outer envelope. Previous studies with *Herschel*/PACS have shown that also the OH/H_2O and O/OH ratios are enhanced in IRS7B (Lindberg *et al.* 2014), suggesting that the externally irradiated outer envelope is a photo-dissociation region (PDR). Abundances of hydrocarbon species are also enhanced, but not to the extent that the source should be considered a warm carbon-chain chemistry protostar (Sakai & Yamamoto 2013).

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