

# High spectral resolution far-IR ISO LWS observations of the Orion BN/KL region: modelling a star forming region

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**Abstract.** The Orion molecular cloud, at a distance of 450pc, is the nearest region of high mass star formation. Its proximity and complexity have made it the target of many astronomical studies. It is mainly composed of two giant molecular clouds; Orion A and B, which are surrounded by HII regions ionized by the UV radiation of the Trapezium stars.

In the Orion A cloud is the OMC1 region, containing several condensations such as the Kleinmann-Low nebulae, which is the brightest infrared region in the complex (Kleinman and Low 1967). The KL nebulae includes an infrared cluster of massive stars at early evolutionary stages (e.g the Becklin-Neugebauer object (BN) and IRC2, which dominate the mid-infrared radiation (Downes et al. 1981)). IRC2 is believed to be the major source of luminosity ( $L \sim 10^5 L_{\odot}$ ), however most recent studies locate the origin of the outflow as being offset from IRC2 at the position of radio source I (Menten et al. 1995), although this is still a matter of debate.

In this poster, we report on high spectral resolution 40-198  $\mu\text{m}$  far infrared (FIR) observations of the Orion BN/KL region taken using the Fabry-Perot mode (LO3) of the European Space Agency's Infrared Space Observatory Long Wavelength Spectrometer (LWS). This is the only high spectral resolution survey taken with an instrument in space and no planned future instrumentation has the same combination of spectral range and high spectral resolution. The data can therefore provide a unique insight into the physical conditions in a massive star forming region, from a spectral region where many of the most important cooling lines are emitted.

The aim of the Poster is to present the data as well as a preliminary study of the astrochemistry of the region, where we explore the chemical evolution in main components: the Hot Core, the Compact Ridge and the Extended Ridge, comparing with observations.

We found that the overall spectrum is dominated by H<sub>2</sub>O (40 lines), OH (20 lines) and CO (20 lines). Forbidden lines of [O III] 52  $\mu\text{m}$ , 88  $\mu\text{m}$ , [N III] 57  $\mu\text{m}$  from the foreground HII region, and the PDR [O I] 63  $\mu\text{m}$  and [C II] 158  $\mu\text{m}$  lines are also detected, while species such as H<sub>3</sub>O<sup>+</sup>, NH<sub>3</sub> and SO<sub>2</sub> are present as weak features. There are seven unidentified lines in the spectrum. We analyze the behavior of the water vapour and OH lines in the spectrum, whose line profiles evolve from predominantly pure absorption, or P-Cygni, at short wavelengths, to predominantly pure emission at long wavelengths. We conclude by discussing the possible origin of all the species found in the spectral survey, emphasising the need to couple chemical modelling with radiative transfer models for complex regions like Orion BN/KL.

**Keywords.** infrared: ISM, ISM: individual(Orion), astrochemistry

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## References

- Downes, D., et al., 1981, ApJ, 244, 869
- Harwit, M. et al., 1998, ApJ, 497, 105
- Kleinmann, D. E., et al., 1967, ApJ, 149, L1
- Menten, K. M. et al., 1995, ApJ, 445, L157