The Expanding Orion Nebula - A combined C+ and CO square-degree map of the Orion A molecular cloud

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We have surveyed a ~1 square degree area centered on the Orion Nebula in the [CII] 158µm line using the heterodyne upGREAT instrument on the Stratospheric Observatory For Infrared Astronomy, resulting in some 2 million spectra at a spatial resolution of 16". In order to study the molecular gas counterpart at similar spatial and (high) spectral resolution, we are carrying out a Large Program with the IRAM 30m telescope to map the ^{12}CO, ^{13}CO and C^{18}O (J=2-1) lines over the same area mapped in C+. These data allow us to study the detailed kinematics of neutral and molecular gas and we detect multiple bubbles in this region. Besides the large bubble associated with the Orion Veil, blown by the stellar wind from the central star θ^1 Ori C, we discuss the bubbles associated with M43 and NGC 1977. We derive the kinetics of the gas flows and compare our findings with models of wind-blown bubbles and models of pressure-driven expansion of HII regions. Disruption of the molecular cores, the birth sites of massive stars, limits the amount of material available for future (high-mass) star formation. Yet, we have detected multiple molecular clumps embedded in the neutral shell that confines the wind-driven Veil bubble. Given the UV irradiation conditions in this translucent material this detection is surprising. It is not clear whether these clumps are transient features or will accumulate enough mass to form low-mass stars.

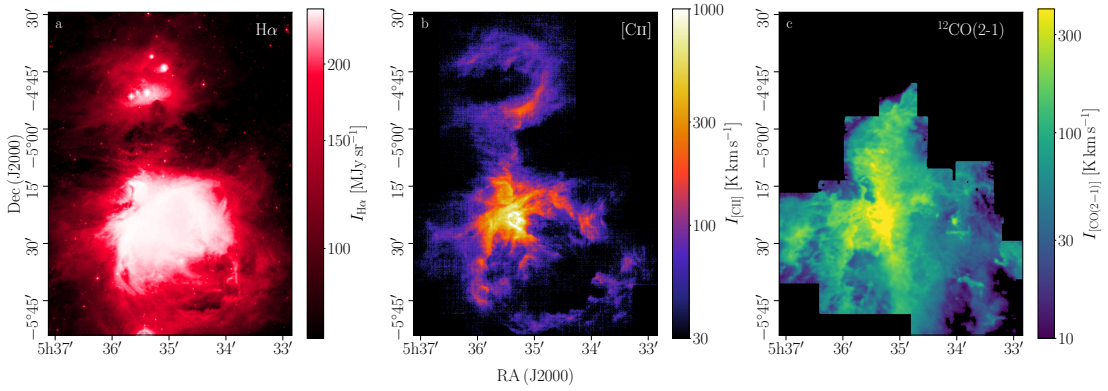

Figure 1: Overwiew of the Orion Nebula (M42), M43 and NGC 1973, 1975 and 1977 at different wavelenghts: a) DSS2 Hα emission (ESO Archive); b) line-integrated [CII] emission; c) line-integrated ^{12}CO (J=2-1) emission (current status). Hα emission stems from the ionized gas (T~10 000 K), the [CII] line is emitted by mostly neutral gas (T~100-300 K), whereas CO traces the molecular gas (T~30-100 K).