WADI & HEXOS

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The interaction of heating and gas dynamics in PDRs

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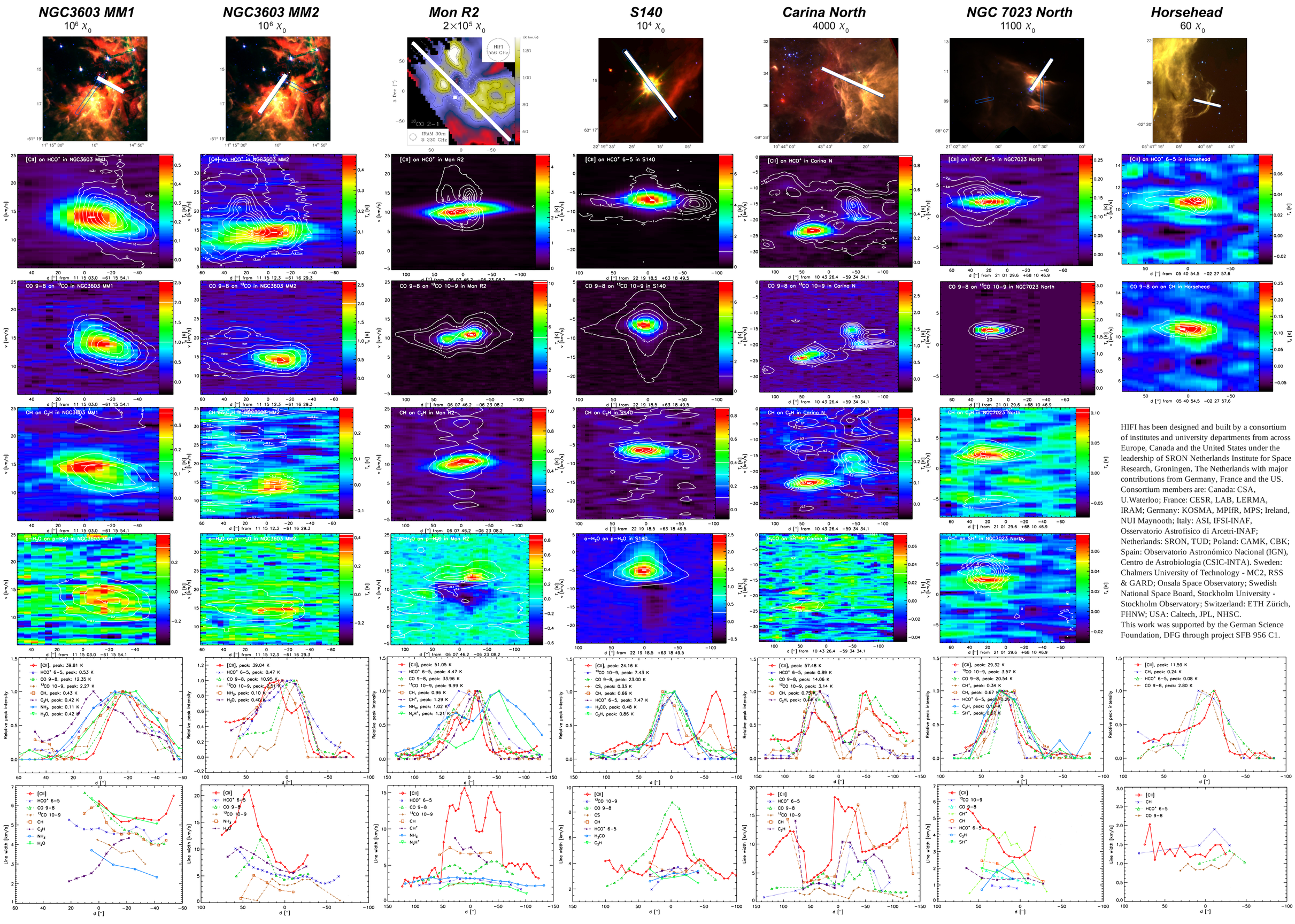
Introduction

Within the Herschel key projects WADI and HEXOS, we obtained strip maps across a number of prominent photon-dominated regions (PDRs) in their main cooling lines and many other tracers not accessible from the ground. Using the information from the complex line profiles of different species allows to deduce the three-dimensional picture of the interface regions including the pressure in the different phases seen in an inhomogeneous PDR and the velocity fields across the interfaces.

Dynamics from position-velocity diagrams



HIFI has been designed and built by a consortium of institutes and university departments from across Europe, Canada and the United States under the leadership of SRON Netherlands Institute for Space Research, Groningen, The Netherlands with major contributions from Germany, France and the US. Consortium members are: Canada: CSA, U.Waterloo; France: CESR, LAB, LERMA, IRAM; Germany: KOSMA, MPIfR, MPS; Ireland, NUI Maynooth; Italy: ASI, IFSI-INAF, Osservatorio Astrofisico di Arcetri-INAF; Netherlands: SRON, TUD; Poland: CAMK, CBK; Spain: Observatorio Astronómico Nacional (IGN), Centro de Astrobiología (CSIC-INTA). Sweden: Chalmers University of Technology - MC2, RSS & GARD; Onsala Space Observatory; Swedish National Space Board, Stockholm University - Stockholm Observatory; Switzerland: ETH Zürich, FHNW; USA: Caltech, JPL, NHSC.

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Interpretation

- The observed layering of species is qualitatively understood
  - Combination of stratified temperature structure through UV heating and chemical photodissociation structure: C^+ - CH - HCO^+ - CO
- Lines broadened towards UV sources
  - Pressure gradient jump at cloud surface
- [CII] shows turbulent tail of material away from the sources. [CII] velocity distribution always considerably wider than that of all other tracers, including HI.
  - Photo-evaporation of cloud surfaces
- For high UV field sources systematic spatial and velocity offset of [CII] relative to the tracers of dense material. C^+ must be blown from the surface into a clumpy medium (see Figure)
  - Low density gas close to UV sources affected by drag of dust grains pushed by radiation pressure.
  - Main effect: Dispersal of material
- Local radiative compression occurs in the direct vicinity of OB stars, but no indications for globally statistically significant radiative implosion, i.e. large-scale triggering of cloud collapse through UV radiation.

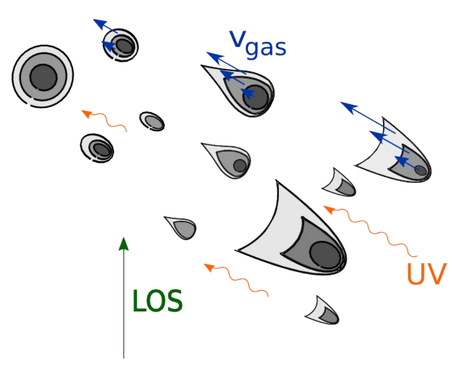

Figure 1: Schematic representation of the gas dynamics in a clumpy PDR with radiative acceleration of thin, photo-evaporating gas, best traced through [CII].