

Water in Star-Forming Regions with Herschel (WISH): Intermediate Mass Protostar – NGC 7129



D. Johnstone (NRC/HIA) and the WISH Team*

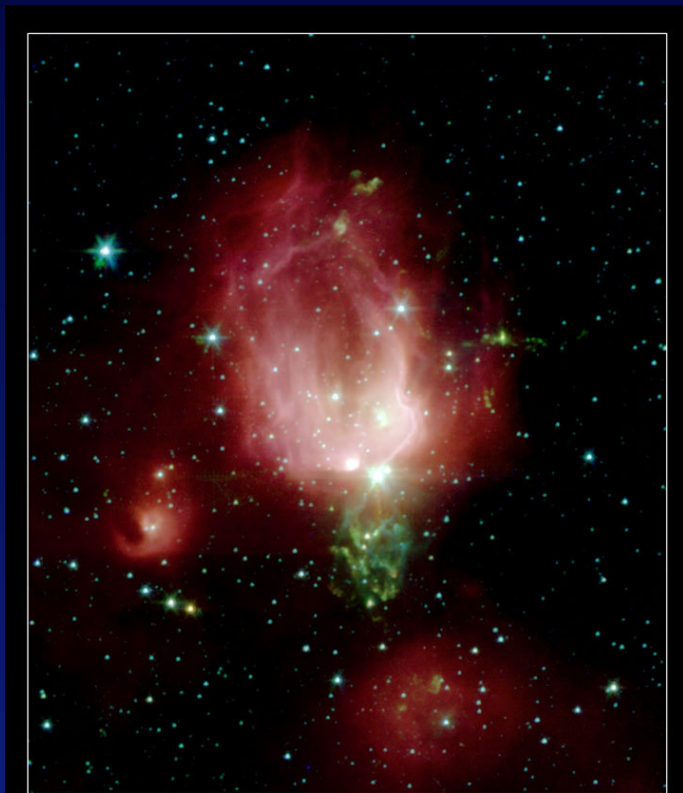


The Herschel HIFI spectrograph is proving to be an excellent instrument for the detection of water in star-forming regions. As part of the WISH Key Program, we are undertaking a study of water in the envelope around six intermediate mass protostars: NGC 7129 FIRS 2, L1641 S3 MMS1, NGC 2071, Vela IRS 17 & 19, and AFGL 490.

The first results, toward NGC 7129 FIRS 2 (see Figure 1), have been completed during PSP and will be published in the A&A HIFI Special Edition (Johnstone et al. 2010). The water and CO spectra reveal broad and narrow components (Figures 2-4) connected to both the free-falling envelope (narrow) and the known energetic outflow (broad) around this source.

Integrated intensity fits to the free-falling envelope component require an outer envelope total water abundance of $\sim 10^{-7}$, although the precise line profiles are not well reproduced. The broad component of water emission appears related to the high- J CO lines observed with PACS (Fich et al. 2010, A&A, 518, L86) which require a very high temperature ($T \sim 1000\text{K}$) and density ($n \sim 10^8 \text{ cm}^{-3}$) shock region.

Figure 1: NGC 7129 (Watering the Rose)



Reflection Nebula NGC 7129 Spitzer Space Telescope • IRAC
NASA / JPL-Caltech / S.T. Megeath (Harvard-Smithsonian CfA) ssc2004-02a

The WISH Team: M. Fich, C. McCoey, T.A. van Kempen, A. Fuente, L.E. Kristensen, J. Cernicharo, P. Caselli, R. Visser, R. Plume, G.J. Herczeg, E.F. van Dishoeck, S. Wamfler, R. Bachiller, A. Baudry, M. Benedettini, E. Bergin, A.O. Benz, P. Bjerkeli, G. Blake, S. Bontemps, J. Braine, S. Bruderer, C. Codella, F. Daniel, A.M. di Giorgio, C. Dominik, S.D. Doty, P. Encrenaz, T. Giannini, J.R. Goicoechea, Th. de Graauw, F. Helmich, F. Herpin, M.R. Hogerheijde, T. Jacq, J.K. Jørgensen, B. Larsson, D. Lis, R. Liseau, M. Marseille, G. Melnick, D. Neufeld, B. Nisini, M. Olberg, B. Parise, J. Pearson, C. Risacher, J. Santiago-García, P. Saraceno, R. Shipman, M. Tafalla, F. van der Tak, F. Wyrowski, U.A. Yildiz

Figure 2: Selection of H₂O Spectra

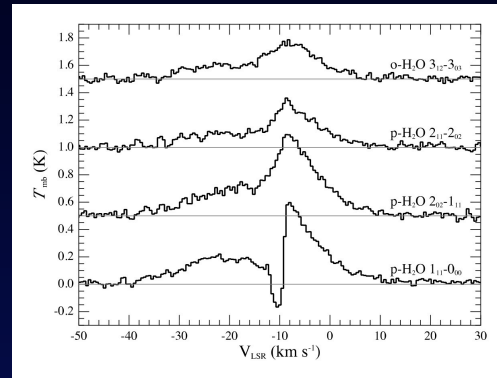


Figure 3: CO and H₂O Compared

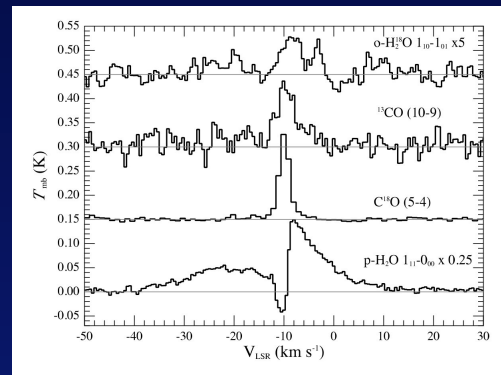


Figure 4: H₂O 2₀₂-1₁₁ Decomposed

