

Results from the TEXES/IRTF H₂ Survey of Disk Sources

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Abstract. Using TEXES, the Texas Echelon-cross-Echelle Spectrograph (Lacy et al. 2002) on the 3m NASA IRTF, we have conducted a search for pure rotational H₂ emission from 18 disk sources spanning a range of age, mass, and accretion rate. TEXES is a high spectral resolution, mid-infrared spectrograph available on the 3m IRTF and scheduled to become available as a visitor instrument on Gemini-North in 2006B. In the case of relatively narrow lines from a point source, TEXES on the IRTF reaches comparable line flux sensitivities to satellite observations (Richter et al. 2002).

Three low-lying pure rotational transitions of H₂ are available from ground-based observatories: J=3-1 ($\lambda=17.035 \mu\text{m}$), J=4-2 ($\lambda=12.279 \mu\text{m}$), and J=6-4 ($\lambda=8.025 \mu\text{m}$). The excitation energies of the upper states make ratios of these lines diagnostic of gas with temperatures between roughly 200 K and 1000 K. The line profile should also contain information about the relation of the emitting gas to the central source.

We observed each source in both the J=3-1 and J=4-2 transitions for roughly one hour. The spectral resolving power was $R\approx 60,000$ for J=3-1 and $R\approx 80,000$ for J=4-2. Roughly one third of the observed sources show either clear or marginal detections of one or both of these lines. For these sources, we conducted follow-up observations of the J=6-4 transition with $R\approx 80,000$. In almost all cases, detected lines are resolved with $\text{FWHM} < 10 \text{ km/s}$. For the best cases, we have information regarding the line flux at three separate transitions and can investigate the physical conditions of the emitting gas. Even for non-detections, we can establish reasonable limits to the amount of warm, isolated H₂ in the system.

TEXES was built with funds from the NSF. This material is based upon work supported by NASA under award No NNG04GG92G and NSF award AST-0307497.

Keywords. circumstellar matter, planetary systems: protoplanetary disks, stars: pre-main-sequence

References

- Lacy, J. H., Richter, M. J., Greathouse, T. K., Jaffe, D. T., & Zhu, Q. 2002, *PASP*, 114, 153
Richter, M. J., Jaffe, D. T., Blake, G. A., & Lacy, J. H. 2002, *ApJ* (Letters), 572, L161

† Visiting Astronomer at the Infrared Telescope Facility, which is operated by the University of Hawaii under cooperative agreement NCC 5-538 with the National Aeronautics and Space Administration, Office of Space Science, Planetary Astronomy Program.