Searching for Water Masers in Pre-protostellar Cores

We requested two hours of time to observe dense molecular clouds that may harbor very young pre-protostellar cores. Currently little is known about the early beginnings of stellar formation. There is an observational gap between dense molecular clouds beginning to collapse from the interstellar medium and young stellar objects around 10,000 years old. Recently the Spitzer Space Telescope has revealed a bright mid-infrared source in the molecular cloud L1014 where previously no object had been observed in any wavelength. The Spitzer Legacy project 'From Molecular Cores to Planet Forming Disks' will look at many more of these clouds. We observed eleven of these objects with the VLA at 1.35 cm in order to detect water masers around any possible pre-protostellar objects located within the clouds. Water masers are known tracers for molecular outflow in young stellar objects.

Table I lists our eleven sources with coordinate information. We observed the water maser transition line 22.235080 GHz in spectral line mode with D array. There were no detections of water masers toward any of our targets. The RMS noise level was similar for all objects; for L1197 in a 0.33 km/s spectral channel the RMS noise was 9.7 mJy/beam.

Although there were no detections in our sample of pre-protostellar cores, water maser observations are still a viable tool for detecting star formation in these clouds. Recent surveys have demonstrated approximately a 22% detection rate toward known sources. This would indicate that if our eleven targets contained sources, only two may have had maser activity. It is also known that water masers are highly variable on monthly time scales (Furuya et al. 2003). Knowing this, future observations of these clouds and others may yield detections.

Table I: Source List

Source Name	RA (J200)*			Dec (J2000)*		
L1197	22^h	37^m	$10^s.00$	+58º	55'	51".0
L1103-2	21	42	16.00	+56	44	20.0
L1507A	4	42	38.6	+29	43	45
L1355	2	53	12.20	+68	55	52.0
L1082C-2	20	49	36.00	+60	14	9.0
L1148	20	40	59.00	+67	21	27.0
L1521F	4	28	39.80	+26	51	35.0
L1155E	20	44	0.00	+67	39	25.0
L1155C-2	20	43	6.00	+67	49	56.0
L1524-4	4	30	5.70	+24	25	16.0
B18-5	4	35	53.00	+24	9	32.0

*All coordinates have been adjusted specifically for Spitzer observations. Given the size of our beam, we determined that the adjustment would not result in any noticeable position error.

References

Furuya, R., Kitamura, Y., Wootten, A., Claussen, M., Kawabe, R., 2003, ApJ, 144, 71.