

## **KVN Surveys of Water and Class I Methanol Masers toward High-mass YSOs**

*Kee-Tae Kim, Chang-Hee Kim, Won-Ju Kim, Hyunwoo Kang, Ji-Hyun Kang, Do-Young Byun, Chung Sik Oh, and the KVN star formation group*

We carried out simultaneous single-dish surveys of 22 GHz water and 44/95 GHz class I methanol masers toward more than 1000 high-mass YSOs in different evolutionary stages using the KVN (Korean VLBI Network) 21-m telescopes. Our sample consists of infrared dark cloud (IRDC) cores, high-mass protostellar objects (HMPOs), and ultracompact HII regions (UCHIIs). We also conducted a linear polarization survey of about 40 strong ( $>50$  Jy) 44/95 GHz methanol maser sources. In this talk, we will present the main results of these KVN maser surveys as follows.

The detection rates of the observed masers tend to increase as the central objects evolve. This is contrary to the trends found in low- and intermediate-mass star-forming regions. Thus, the occurrence of these masers might depend on the surrounding environments as well as on the evolution of the central object. We detected many new water and class I methanol maser sources. The 44 GHz methanol masers have much narrower distributions than 22 GHz water masers in the relative peak velocity and velocity range, while associated 6.7GHz class II methanol masers have distributions intermediate between the two. The 95 GHz methanol masers were always detected in the 44 GHz methanol maser sources. The two maser transitions have the same peak velocities and show significant correlations in the peak velocity, peak flux density, isotropic luminosity, and linear polarization flux and angle. This indicates that they are likely produced in the same sites by the same mechanisms.