Influence of Convection on Line Asymmetry

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We attempted to analyze atmospheric inhomogeneities and velocity fields by examining quantitative behavior of their line asymmetry. As the result, it is found that the surface inhomogeneities and the strength of the velocity overshooting increase as one goes to earlier spectral types.

SiO Maser Survey and Statistical Study of Mira Varible Stars

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The simultaneous observations in six transitions of silicon monoxide; ^{28}SiO, $J=1\rightarrow0$, $v=0, 1, 2, 3$ and ^{29}SiO, $J=1\rightarrow0$, $v=0, 1$ were performed for 106 late type stars using the 45m telescope of Nobeyama Radio Observatory. 83 sources were detected and 26 of them were new SiO maser emission sources. The ground vibrational ^{29}SiO maser emission generally occurs at the stellar velocity. In most cases, ^{29}SiO maser emission are narrower and stronger than ^{28}SiO $v=0$ emissions, in spite of less abundance of ^{29}SiO, i.e. $(^{28}\mathrm{SiO})/(^{29}\mathrm{SiO})\simeq20$.

Based on the above observational results, extensive statistical analyses were carried out to test for the correlations between various SiO emission properties and the stellar parameters. Clear correlation was found between SiO and IR flux densities. Several evidences for phase dependence of SiO maser were found. Almost all of the $v=3$ and $v=0$ emissions are observed only for the stars with optical phase of about 0.2. The $v=1$ and $v=2$ masers tend to show maximum flux near the phase of 0.2.

Detailed analyses for velocity structures reveal that the vibrationally excited masers of $v=1$ and $v=2$ show redshifted mean velocities during the phase from 0.3 to 0.8, while sources with blueshifted mean velocities are dominant during the phase from 0.8 to 0.2. This fact shows that the line formation region of the vibrationally excited SiO masers is located very close to the star and directly affected by the stellar pulsation.

Bipolar Molecular Outflows in NGC 7023

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NGC 7023 have been observed in ^{12}CO and ^{13}CO ($J=1\rightarrow0$) molecular line emissions. It possesses bipolar molecular outflows which are moving out both eastward and westward in Right Ascension with a velocity range of ±9 kms^{-1} with an inclination of $\sim80°$. The mass loss rate is$\sim10^{-5}$ $M_{\odot}yr^{-1}$ with an assumed stellar wind velocity of$\sim$100kms^{-1}; the dynamical age of this outflow is $\sim5.5\times10^{4}$ years. The bipolar molecular outflows would be collimated by the molecular disk surrounding HD 200775, which is explained by either the velocity gradient of 0.25kms^{-1} arcmin^{-1} in the position-velocity map of ^{12}CO along the Declination or the peak temperature maps of