High Dynamic Range Images of Silicon Sulfide Toward IRC+10216

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The dynamic range of aperture synthesis images at short mm wavelengths is often limited mainly by atmospheric fluctuations which perturb the measured source visibility. If the emission is sufficiently bright and the instantaneous (u,v) coverage is sufficiently complete, self-calibration techniques can be used to recover lost dynamic range and approach the limit set by the system thermal noise.

This paper presents maps of the circumstellar envelope of the carbon star IRC+10216 in the J=13-12 emission line of silicon sulfide (SiS) at λ1.3 mm made with the OVRO array. The spatial resolution is 2.5 arcsec and the velocity resolution across the $\sim$30 km/s-wide line is 0.6 km/s. Self-calibration of the integrated line emission yielded an image with a dynamic range in excess of 400:1. By applying the time-dependent antenna gain solutions derived from the self-cal image to individual spectral channels, a dynamic range of >100:1 was obtained in most of the channel maps. These maps imply that the SiS emission arises from numerous small—mostly unresolved—clumps which occur at discrete velocities across the line profile. The images suggest that the mass loss process in this AGB star occurs by ejection of many small dense clumps of gas distributed randomly over the stellar photosphere. These gas clumps may be related to the warm dust clumps seen in high resolution IR images of IRC+10216.

Abstract submitted for Science with the Atacama Large Millimeter Array, 6 – 8 October 1999, Washington, D. C.