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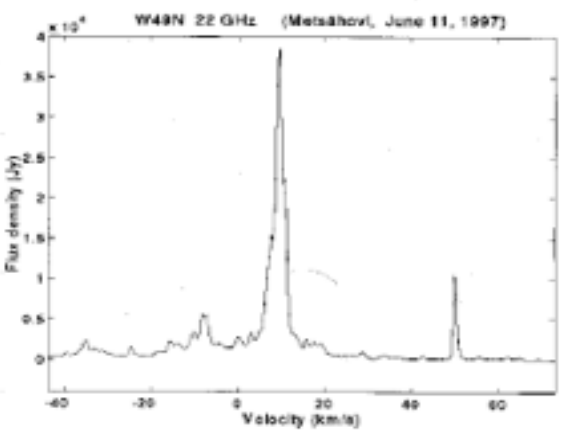
Masers and The Massive Star Formation Process

Masers:

The radio radiation detected at some transitions of astronomical molecules is attributed to the natural occurrence of the **maser** phenomenon (**mi**crowave **a**mplification by **s**timulated **e**mission of **r**adiation). The first interstellar maser was discovered in 1965 (Weaver et al. 1965). Masers are the brightest and most spectacular phenomenon that radio astronomers can study. Strong maser action was first detected in (OH) at (1.6 GHz) and water (at 22GHz) in star forming regions. The main molecular species which produce masers in star-forming regions are hydroxyl (OH), water (H2O), silicon monoxide(SiO), methanol (CH3OH), ammonia (NH3), Hydrogen cyanide (HCN), Formaldehyde (H2CO), etc…

Cosmic masers provide the most readily detectable indicators of the formation of massive young stars, and offer the best prospect for making a complete census of star forming regions in the galaxy. They are one of the first observed signpost of high mass star formation, particularly the hydroxyl (OH), water (H2O) and methanol (CH3OH) masers, that are common and intense. However, there is still a great need for verifying what the relation is between specific stages and classes of massive star formation and different masers.



Another signpost of massive star-forming regionsis near infrared (NIR) and mid-inferred (MIR) emission. Significant surveys by IRAS, WISE and Spitzer have been completed.

The aim of this project is to probe and investigate the massive star-forming region using radio data

from Hartebeesthoek radio astronomy observatory (Hartrao) and infrared archived data from WISE and Spitzer surveys to determine where each phase of these massive star-forming can be found. Hartrao have monitored a large sample of a hydroxyl, water and methanol masers.

For archived infrared data we will be using Virtual Observatory (VO, see below for a brief description) tools to compile data from WISE and Spitzer surveys. The VO tools that we will be using are: TOPCAT, ALADIN, XMatch, Open Sky Query…

The Virtual Observatory:

Virtual Observatory (VO) could be defined as a collection of integrated astronomical data archives and software tools that utilises computer networks to form a scientific research environment in which astronomical research can be conducted. The VO consists of a number of data centres each with unique collections of astronomical data, software systems and processing capabilities. Several countries have initiated national virtual observatory programs that combine existing databases from ground based and orbiting observatories. As a result, data from all the world's major observatories are available to all users and to the public. This is significant not only because of the immense volume of astronomical data but also because the data on stars and galaxies has been compiled from observations in a variety of wavelengths — optical, radio, infrared, gamma ray, X-ray and more. In a virtual observatory environment, all of this data is integrated so that it can be synthesised and used in a given study.

Reference:

Weaver H, Williams D.R.W., Dieter N.H & Lum W.T: 1965, Nature, 208, 29.