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Hamburger Sternwarte

A Database of Circumstellar OH Masers

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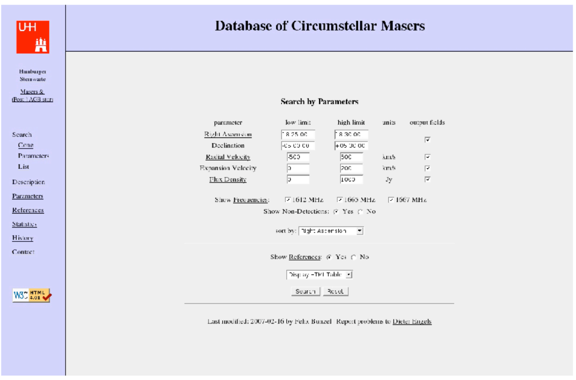
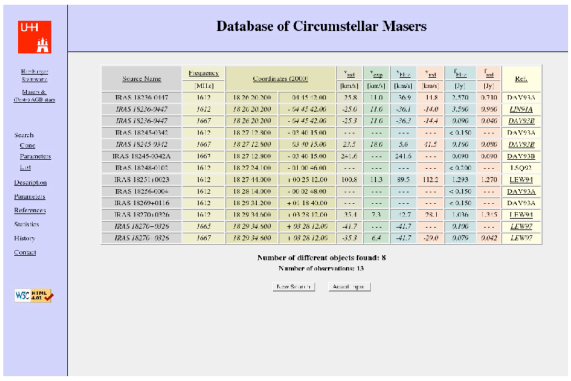
We present a new database of circumstellar OH masers at 1612, 1665, and 1667 MHz. The database contains 10769 observations and 2243 stars with OH maser emission detected. The database contains flux densities and velocities of the two strongest maser peaks, the expansion velocity of the shell and the radial velocity of the star. Access to the database is possible over the Web, allowing cone searches for individual objects and lists of objects. Object selection is possible on the base of flux densities and velocities.





Data access: www.hs.uni-hamburg.de/maserdb

Introduction

Since the discovery of masers 40 years ago several thousand observations to detect masers have been made. Comfortable tools to access these observations are lacking. The last catalogues listing 1612 MHz OH masers in AGB stars ("OH/IR stars") were published by Te Lintel Hekkert et al. (1989) and Benson et al. (1990). The Te Lintel Hekkert catalogue contains detected OH masers with their flux densities and velocities and covers the literature until 1984. The Benson et al. catalog lists references to OH maser observations and covers the years until 1989. The number of detected 1612 OH Masers listed are 439 and 713 respectively. The number of detected maser has almost tripled since then.

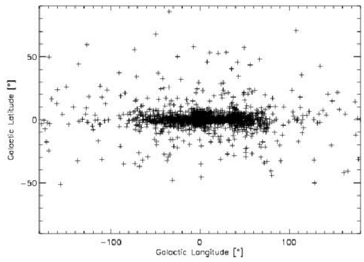


Figure 1:
Distribution of 2243 OH/IR stars. The strong concentration to the galactic plane is in part due to the restricted latitude coverage of the major OH maser surveys.

The database

Input to the database started with the contents of the Te Lintel Hekkert catalogue. The additional literature search covers the years 1984 - 2006. The database is considered to be (almost) complete for 1612 MHz detections, but contains no non-detections published prior to 1984. For the main lines only measurements published after 1984 are contained.

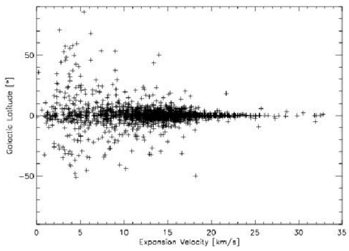


Figure 2:
Galactic latitudes vs. velocities v_{exp} of the circumstellar shell as measured from the double-peaked OH maser spectra.

Spatial distribution

To allow a quick overview of the contents of the database we provide in the following some simple statistics. The distributions shown are affected by selection effects due to the different sensitivities and sky coverages of the contributing surveys.

Figure 1 shows the distribution of the sources in galactic coordinates. Most detections are confined to latitudes $|b| < 4°$, and there are very few detected sources outside the solar circle.

Expansion velocities

Figure 2 shows the distribution of the expansion velocities v_{exp} with galactic latitude. v_{exp} was assumed to be half the velocity difference between the two OH maser peaks making up a typical maser profile in OH/IR stars. The v_{exp} distribution is strongly peaked at 14 km/s. Almost all high-latitude sources have rather small expansion velocities, indicating that v_{exp} is statistically an indicator for main-sequence mass. High expansion velocities (>18 km/s) are found only near the galactic plane (±1°), i.e. they are reached only by the higher mass AGB stars.

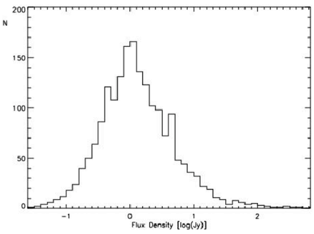


Figure 3:
Flux density distribution. The peak is at ~1 Jy. The decrease of the number of sources at F < 1 Jy is due to the limited sensitivity of the major surveys.

Flux densities and maser luminosities

Figure 3 shows the flux density distribution, where the flux densities are taken the sum of the two peak flux densities. The break at ~1 Jy is due to the sensitivity limit of the major single-dish surveys, which contribute most of the sources. The flux densities were converted into luminosities by assuming kinematic distances (Figure 4). In ambiguous cases the near kinematic distance was taken. The luminosity distribution show a broad peak between 100 and 1000 * 10^{-13} Watt/Hertz, which predominantly is made up by standard 1 Jy sources located several kiloparsec away from the sun. The luminosity of sources, for which the far kinematic distance is a better estimate, will be underestimated in Figure 4. There is however no distinctive peak in the low luminosity part of the distribution, which could be assigned to these sources.

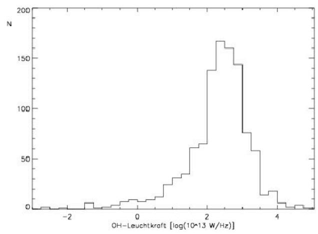


Figure 4:
OH Maser luminosity distribution assuming (near-)kinematic distances. A typical 1 Jy maser contributes to the broad luminosity peak $2 < \log(L_{OH}) < 3$ at distances $3 < d < 12$ Kpc.

The projected distribution of the OH masers on the galactic plane is shown in Fig. 5. Sources with ambiguous kinematic distances are plotted twice, in red for the near and in blue for the far kinematic distance. In principle, the masers can be used to detect stars far beyond the galactic center, but it was not possible to resolve the distance ambiguity with the maser data alone. An extension of the database with infrared data of their counterparts may allow this in future.

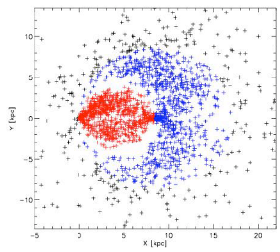
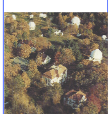


Figure 5:
Distribution of the OH/IR stars in the Milky Way assuming kinematic distances. The Sun is at x=0, y=0, the Galactic Center at x=8.5, y=0. Position assuming a near (far) kinematic distance are shown in red (blue). The empty regions are artificial because of large gradient in the line-of-sight velocities

References:
Benson, P.J.; Little-Marenin, I.R., Woods, T.C., et al., 1990, ApJS 74, 911,
Te Lintel Hekkert, P., Versteege-Hensel, H.A., Habing, H.J., Wiertz, M., 1989, A&AS 78, 399



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