OH MASERS IN ENVELOPES OF LATE TYPE STARS

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ABSTRACT. Two studies of OH maser emission in envelopes of late type stars -miras (3) and OH/IR objects- have been performed with the Nançay radio-telescope. Mainly, the OH miras are found with thicker dust envelopes than the non OH ones. A sample of unidentified IRAS point sources selected on their colors has been observed. We have detected 46 new OH sources. The OH detection rate is a function of the galactic longitude and of the IRAS spectral classification.

1. MIRA STARS

1.1. The sample

The Mira type red giants are long period variables, with an important mass loss ($\sim 10^{-6}$ $M_\odot/y$) and then a cold (some 10^2K) gas and dust envelope ($\sim 10^3$ stellar radius) where OH masers are often observed. We have selected all known oxygen-rich miras within 1 kpc of the sun ($\sim$230 objects) for a high sensitivity search (0.08 Jy) of 18cm OH maser lines (1612, 1665 and 1667 MHz).

1.2. Results

From Lockwood (1) we got the M spectral type at optical maximum. OH emission is not possible below M5.5, and is very common above this limit. The OH detection rate only increases continuously with increasing period without clear limit between OH and non OH stars. Near the galactic plane, this rate is better and an OH star has a higher probability to present type II (1612 MHz line) emission ; likely a stronger UV intensity in this plane increases photodissociation of H_2O in OH.

The colors (logarithmic ratio of νSv) between the IRAS flux densities S_ν are a little different from blackbody colors. The mean [25-12] color increases from non OH to type I OH, and to type II OH miras, but the [60-25] color does not. All miras follow the same relation between the normalized flux densities at 1 kpc, Fv=Sv*d^2. So the colors are functions of only one flux. OH masers (specially type II) need bright envelopes,

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i.e, log [Fv(12)]>1.2 (Fv in Jy), and are very common above this limit ; moreover the OH miras mainly belong to IRAS LRS class 2 (silicate band in emission), the non OH miras to class 2 (silicate band in emission), the non OH miras to class 1 (no band) : OH miras have thicker dust envelopes than non OH ones. So their colors differ because their mean fluxes strongly differ (at least from 1 to 300) ; it does not reveal other differences.

2. NEW OH/IR OBJECTS

2.1 Selected sources

A color-color plot between the 12, 25 and 60μm IRAS fluxes shows a sequence from the bluest objects (non OH Miras, mainly class 1) (3) to the reddest OH/IR objects with thick envelope (mainly class 3 -silicate band in absorption- or 2) (2). We have searched for the OH counterpart of the IRAS point sources located in the delineated box $0.20<12/25<0.45$, $1.87<25/60<6.61$, corresponding to OH/IR objects, for which a LRS spectrum (class 1-4, 4 : SiC band in absorption) had been obtained (202 sources). Presently we have observed 120 objects at 1612 MHz. The sensitivity limit is 0.15 Jy. 66 OH/IR stars were detected (46 new detections)

2.2. Results

Selected IR objects are mainly located in the galactic arms. A histogram of these objects shows peaks in the direction of the spiral arms. Moreover OH detection rate is higher between 350° and 70° (70%) than between 70° and 250° (30%). This part of longitude corresponds to the galactic arms where ultraviolet radiation density in the strongest, and could produce OH molecules in envelopes of the stars by photodissociation of H_2O molecules.

The detection rate clearly increases from class 1(17%) to 3(68%), consequently with the envelope thickness, furthermore the detection rate of class 4 is peculiarly high : 50 %. The OH flux in classes 3-4 is on average stronger than in classes 1-2. 88% of the classes 1-2 sources have a mean peak flux < 2Jy ; 66% of the classes 3-4 sources have a mean peak flux > 2Jy.

If we draw in the selected bow a line parallel to the locus of blackbodies the OH detection rate is higher below than above this line. This fact may be due to differences of the envelope mean thickness, or of the 35μm flux, which pumps the 1612 MHz masers.

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