OH MASERS / MEGAMASERS

Project: GBT 2
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Definitions

- What is a Maser?

  A maser is an optical amplifier that produces coherent microwaves due to stimulated emissions. A maser line is the brightest spectral line in the radio universe. It highlights stars forming regions, dense circumstellar shells around evolved stars as well as circumnuclear disk around blackholes of galactic nuclei.

  Microwave Amplification by Stimulated Emissions of Radiation

- What is a megamaser?

  A megamaser is an extragalactic source with an unprecedented isotropic luminosity of $\sim 10^3 L_\odot$.

  It is a million times more luminous than nearby sources of masers.

  Almost 100 OH type and 60 H$_2$O type megamasers have been detected by this time.
Science Background

Masers were discovered more than 25 years ago. Research in this astronomical area has experience great growth due to interferometric techniques. Masers are used for the study of astronomical environments, where radiation is created and in through which it propagates.*

Science Background

- Objects showing masers emissions:
  - Stars
  - Galaxies
  - Star forming regions
  - Supernovas
Science Background

- Types of masers:
  - OH
  - H$_2$O
  - SiO
  - CH$_3$OH
  - NH$_3$
  - OH Megamasers

Most of these molecules are produced during the birth process of a star due to powerful shocks that generates strong stellar winds with high velocity that runs into high density magnetized material.*

Observations

- Sources observed:
  - W3OH - Star forming region
  - TCom - Star
  - RHya - Star
  - WLeo - Star
  - Arp220 - Extragalactic source
  - Mrk231 - Extragalactic source*
  - IRAS 10173+0828 - Extragalactic source*

*These sources were observed with no clear results due to possible RFI and/or noise.
SOURCE: W3OH (STAR FORMING REGION)
SOURCE: TCOM (STAR)

SOURCE: RHYA (STAR)
Source: WLEO (STAR)

Scan 1005 Y: 19:40 UT-UTC F0: 1,861.38 GHz Pol: I Type: 10.14
2005-07-13 RA: 08:01 17.8 Dec: 01:38 01.2 Beam Width: 0.00134 GHz, 20.2, 20.2, 20.2

Scan 1006 Y: 19:40 UT-UTC F0: 1,861.38 GHz Pol: I Type: 10.14
2005-07-13 RA: 08:01 17.8 Dec: 01:38 01.2 Beam Width: 0.00134 GHz, 20.2, 20.2, 20.2
Results

<table>
<thead>
<tr>
<th>SOURCE S</th>
<th>DISTANCE S (pc)</th>
<th>TYPE</th>
<th>INT. FLUX (Jy Km/s)</th>
<th>L/L☉ (SNR)</th>
<th>T.sys (K)</th>
<th>RMS/Calc</th>
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<tbody>
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<td>W3OH</td>
<td>2200</td>
<td>SFR</td>
<td>432.34</td>
<td>3.6 10⁻⁶</td>
<td>41.52</td>
<td>0.02/0.017</td>
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<tr>
<td>TCom</td>
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<td>*</td>
<td>1.97</td>
<td>5.2 10⁻⁹</td>
<td>15.05</td>
<td>0.01/0.009</td>
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<tr>
<td>RHya</td>
<td>617</td>
<td>*</td>
<td>17.05</td>
<td>1.1 10⁻⁸</td>
<td>16.67</td>
<td>0.01/0.008</td>
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<tr>
<td>WLeo</td>
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<td>*</td>
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<td>3.4 10⁻⁹</td>
<td>15.17</td>
<td>0.01/0.009</td>
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<tr>
<td>Arp220</td>
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<td>EG</td>
<td>52.20</td>
<td>512</td>
<td>16.33</td>
<td>0.008/0.006</td>
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</table>

Table 1. Integrated fluxes and luminosities.
Summary

Statistical analysis of masers can provide great information about the stages and evolutionary schemes of the stellar population. Information that, otherwise, will stay completely hidden by thick dust shells in the universe.

Perspective

Great knowledge has been gathered from this project and we all know that this experience will be of impact and contribution to our professional development.
References

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