Radio Recombination line observations of a compact HII region

Mayra E. Lebrón Santos

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1 Background

The birth and early evolution of massive stars and their effects upon their environment are among the major topics of star formation studies. Young massive stars are located inside their natal molecular clouds. Due to their intense radiation in the ultraviolet, these stars are able to dissociated and ionized the surrounding molecular gas. The ionized region is called HII region while the photodissociated zone is called PDR. The observational study of the inter-relation between the ionized, neutral, and molecular regions is fundamental to obtain a global understanding of the early evolution of new-born massive stars.

In this project we will concentrate in study the emission from the HII region and radio recombination lines are one of the best tools for that.

2 Observations strategy

2.1 Receiver and line selection and integration time

Considering that we want to observe a recombination line we are flexible in the receiver to use because recombination lines are observed at all frequencies. For this project we will be working with the Xband receiver that goes from 8 to 10 GHz and has a beam diameter of $\sim$ 30 arcsec. The receiver system temperature is between 50 and 55 K (depending on the location in frequency in the band) and will be required to obtain the rms noise in the spectrum. The desired velocity bandwidth per channel is around 0.2 km s^{-1}. When observing with a single dish telescope, the theoretical rms noise in the spectra is given by,

$$\Delta T(K) = 2\frac{T_{sys}}{\sqrt{B \ \ t_{int}}}$$

where T_{sys} is the system temperature (in Kelvin), B is the bandwidth per frequency channel (in Hz) and t_{int} is the total integration time per circle (in sec). Therefore, for a given receiver, the rms noise, the bandwidth per channel and the integration time are closely related.

Here is the list of recombination lines and their respective frequencies that are accessible for the Xband receiver:

Table 1: Xband Recombination Lines (Hydrogen, Helium and Carbon)

Line	$\nu_\circ$(MHz)
H93α	8045.603
He93α	8048.882
C93α	8049.617
H92α	8309.383
He92α	8312.769
C92α	8313.529
H91α	8584.821
He91α	8588.320
C91α	8589.104
H90α	8872.569
He90α	8876.184
C90α	8876.995
H89α	9173.321
He89α	9177.059
C89α	9177.898
H88α	9487.822
He88α	9491.688
C88α	9492.555
H87α	9816.865
He87α	9820.865
C87α	9821.762

2.2 Observing parameters

Before starting the observations you need to have the following information:

- The sources list visible with Arecibo telescope for the scheduled time. For checking the source rising and setting LST visit:

  $http://www.naic.edu/\sim astro/misc/risenset-apr2103.html$,

  or $http://www.naic.edu/\sim phil/misc/srctrkhadec.ps$.

- The recombination line or lines to be observed.

- The bandwidth and resolution neccesary for the observations (See section *Correlator boards* of AO spectral line manual at

  $http://www.naic.edu/\sim astro/spectral\ line/handbook/index.shtml$).

- The telescope observing file. Use offline CIMA. For that you would need to login in remote.naic.edu and type */home/aoui/bin/cima* to start the program.

3 Things to do during the observations

You will need to bring the source list, AO Spectral Line observing log sheet, and a pencil. Remote observers are requested to call the operator 15 minutes before the observation to obtain the current password for the 'dtusr'.

- Log into remote.naic.edu with the *school* username (use slogin) .
- Log into observer2 as dtusr using slogin, i.e. slogin observer2 -l dtusr
- From the observer prompt, type *cima*.
- Load your observing set-up file and verify all the parameters.
- Start the observations
- On another computer log into remote.naic.edu as school and then type: /home/aoui/display/solaris/aostatus&. That will open the AO status display.

For looking at the data during the observations, you will need to log into remote.naic.edu as school (use slogin) from another environment or computer. From remote, open an xterm and type idl.

Inside idl, type:
@corinit
openr,lun,'/share/olcor/corfile',/get_lun
cormonall,lun