

PROPOSAL TITLE: Updating the Molecular line Search Capabilities in GBTIDL

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1. Introduction:

Currently, GBTIDL has the molecule and recombatt tasks. The molecule task plots the molecular line frequencies of previously detected molecular lines that are stored in !g.molecule on the currently displayed plot at the appropriate location given the current x-axis. The recombatt task plots the hydrogen (alpha, beta, and gamma), helium (alpha and beta) and carbon (alpha) recombination lines on the currently displayed plot.

We would like to upgrade the current version of molecule and recombatt by combining them into one single task called “splat.” In addition, we would like to include more specific options for the user. The current list of previously detected molecular lines included in gbtidl is very outdated and limited. We would therefore provide an updated offline database of splatalogue, similar to that used by the OT and CASA to be included into gbtidl.

2. Background:

Currently in gbtidl, a user has the option to use the task “molecule” to plot molecular lines and the task “recombatt” to plot selected recombination lines. We propose to combine the recombatt and molecule option into a “splatalogue” or “splat” task. This will allow the user to plot molecular species, recombination lines, and atomic lines, which are currently not available in gbtidl, using one single task.

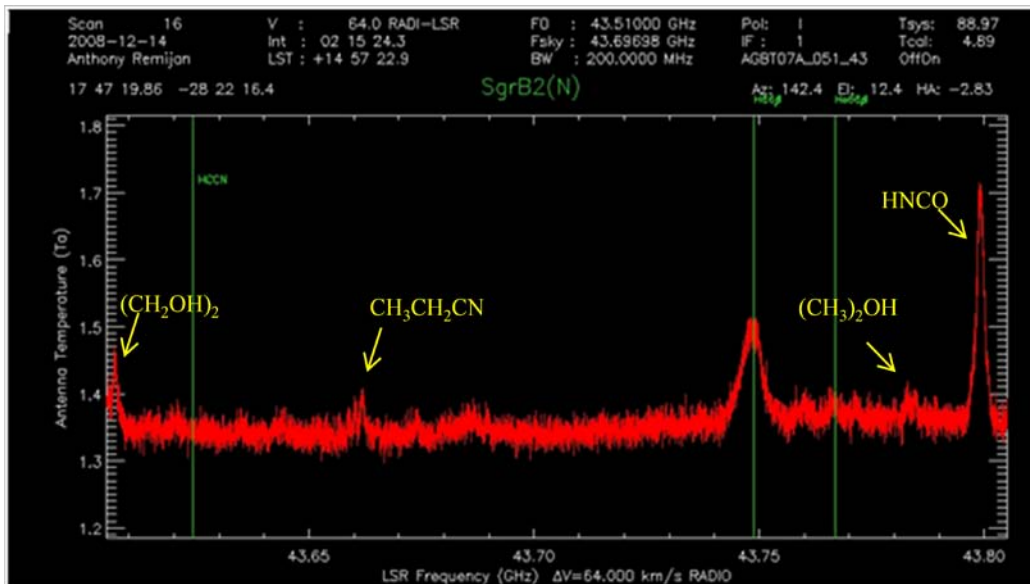


Figure 1: Example window from SGRB2(N) data within GBTIDL displaying the limited nature of the molecule and recombatt task (see text).

Currently, the molecular lines contained in !g.molecule in GBTIDL are outdated and the information provided to the user after executing molecule is very limited. Figure 1 provides an example of a 200

MHz window taken from GBTIDL from the hot core source SgrB2(N). Upon executing molecule, a single molecular line of HCCN is plotted, shown in green. No other information about the species is given (i.e. transition quantum numbers and energy). The user then must execute “recomball” to determine any recombination lines present within the data range. Yet, as seen in Figure 1, there are still many unidentified species within the plot range. Upon manually searching through the online splatalogue catalogue, it is shown that several commonly known species in this source have been missed which are labeled in yellow in Figure 1.

3. Suggested improvements:

To improve the quality of the new “splat” in GBTIDL, we propose add search options to provide more functionality and information to the user. Suggested search and output options include:

- 1) Search by molecule name
- 2) Search by frequency range
- 3) Energy range search or upper energy level cutoff for species (in cm^{-1})
- 4) Astronomical Filter option
- 5) Specify the desired redshift.
- 6) An option to output the molecular information to the terminal or to a file.
- 7) An option to include the transition quantum numbers on the plot with the species

The user does not need to specify the options above. If the user simply executes “splat”, all detected lines in the updated offline database within the frequency range of the currently displayed plot will be plotted at the appropriate location on the x-axis. However, the user can set any of the above parameters from the default value to limit the plotting options.

These search options will follow closely the search options we currently have set on the splat basic page. If the user decides to search by molecular name, they should type the full name or partial name of the species to plot the transitions for the species. For example, entering ‘carbon’ for the molecular name will return all atomic carbon species and isotopologues as well as all carbon monoxide species, isotopologues and vibrational states within the plot range.

For astronomical filters, the user should be allowed to limit the plotted molecules by popular species or specific regions of space.. The options will include the quick picker option, which will only allow the top selected species to be plotted in addition to options including planetary atmospheres, dense clouds, diffuse clouds, hot cores, comets, AGBs/PPN/PN, comets, and extragalactic, which will only plot species that have been previously detected in these astronomical sources.

All of this information will be provided in an updated offline version of the splatalogue database that can be incorporated into GBTIDL.