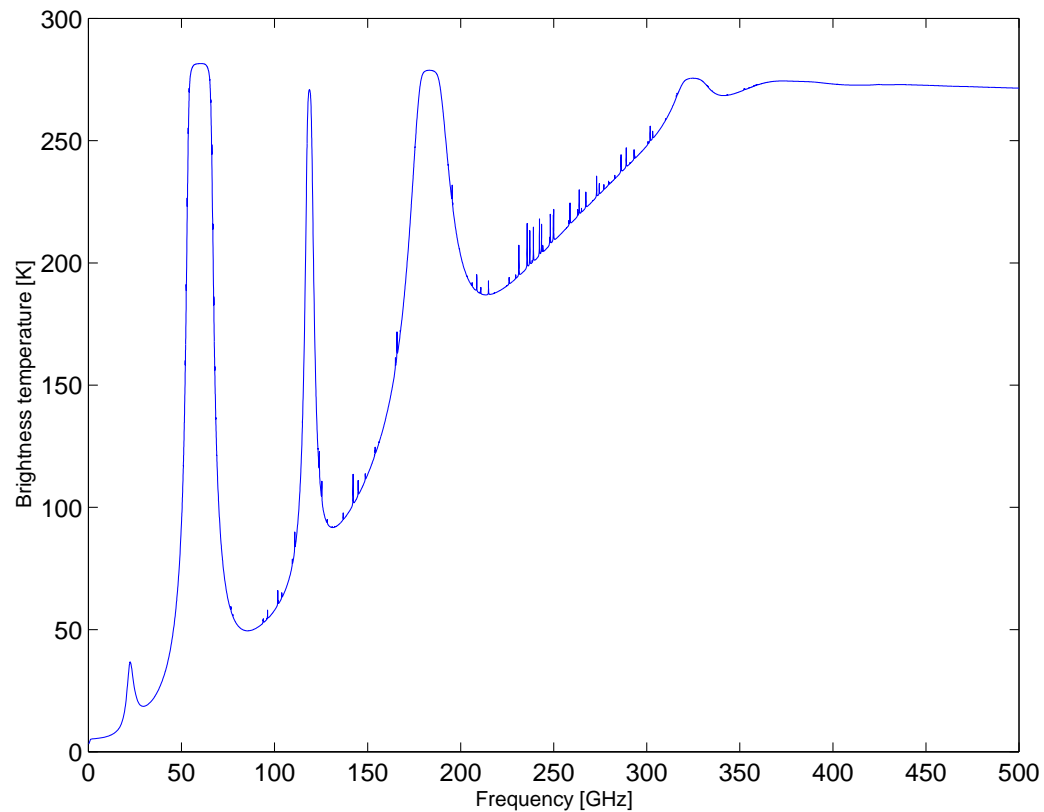# BEAMCAT: the BErnese Atmospheric Meta Catalog Access Tool

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http://www.iapmw.unibe.ch/research/projects/BEAMCAT/

Simulating microwave spectra

Necessary input

- Pressure, temperature, trace gas distribution

- Spectral line amplitude and broadening information

- Radiative transfer function

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Spectral line databases

JPL catalog

- 335 species

- 1931099 spectral lines

- 150 MB total size

- microwave region

HITRAN

- 36 molecules with 94 isotopes

- 1080174 spectral lines

- 105 MB total size

- microwave and infrared

Why not use a single database?

In most cases, a single catalog simply is not good enough because of

- data quality issues

- format limitations

- incomplete information

Solution: combine data from several sources

The merging problem: lost information

Several attempts have been made before to combine data from more than one catalog. The usual way was to produce a merged catalog with a new format (JPLHITRAN, VERDANDI). All these catalogs suffer from the same problems:

- they are too specific

- they are difficult to update

- they throw away information in the merging process

- they are hardly able to handle more than two sources

The BEAMCAT solution: using a meta catalog

Instead of producing a merged catalog with the problems mentioned before, BEAMCAT takes a new approach: a **meta catalog**. A meta catalog only contains information that identifies the same transitions in different catalogs. This has many advatages:

- on-the-fly merging according to users's wishes

- easy updates

- all information is retained

- unlimited number of catalogs

SQL Database setup

BEAMCAT keeps its data in an SQL-based database instead of single files. That has many advantages over the single-file approach used by the other catalogs:

- indexed columns allow fast sorting and searchung in any column

- output format can easily be changed

- new parameters can be added any time

- allows easy web access

Building the meta catalog

The meta catalog has to be build once by identifying the same lines in all the catalogs. This has to be done by comparing quantum numbers. Unfortunately, the comparison of quantum numbers in different catalogs is not straightforward. Very often, quantum numbers are missing or incomplete. There are two ways to compare a set of quantum numbers:

1. **Positive match:** they are considered equal if all numbers agree.

2. **Negative mismatch:** they are considered equal if none of the numbers disagree.

The negative-mismatch-approach is much more useful for identifying lines in the JPL and HITRAN catalog.

Robust line matching scheme
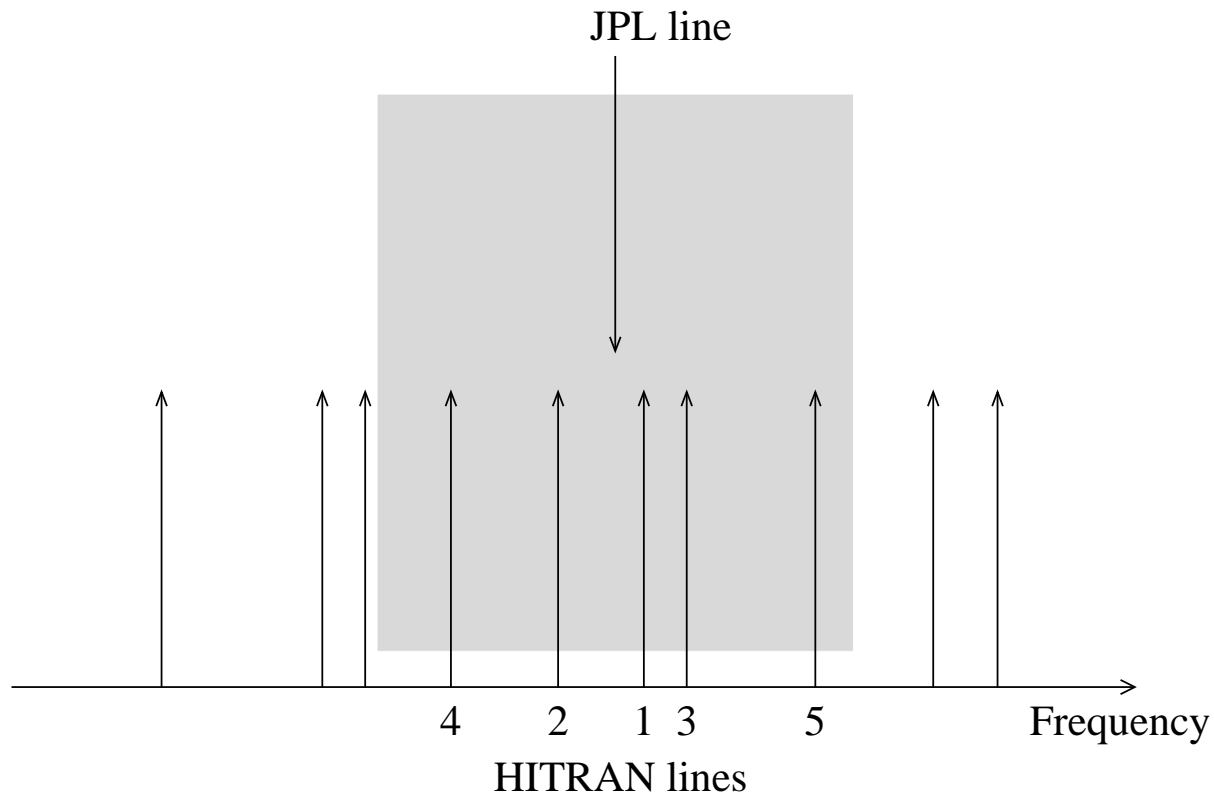
Start from the closest frequency match and continue until none of the quantum numbers disagree

Access to BEAMCAT data

The BEAMCAT data can be accessed through a web interface at

http://www.iapmw.unibe.ch/research/projects/BEAMCAT

Users can select which data they want and retreive it directly through their browser.

Alternatively, the MySQL database can be accessed through a command-line interface. Application programming interfaces (APIs) exist for PHP, Perl, C, C++, Python and other languages.

Conclusions

BEAMCAT takes a completely new approach and solves most of the problems of other spectral line catalogs. It should be useful for everybody who uses spectral line catalogs because

- it has all the information from all source catalogs

- it is format-independent

- it has an easy-to-use web interface

- it can be updated easily

The next step will be to integrate other spectral line catalogs besides JPL and HITRAN.