emaa

Excitation of Molecules and Atoms for Astrophysics

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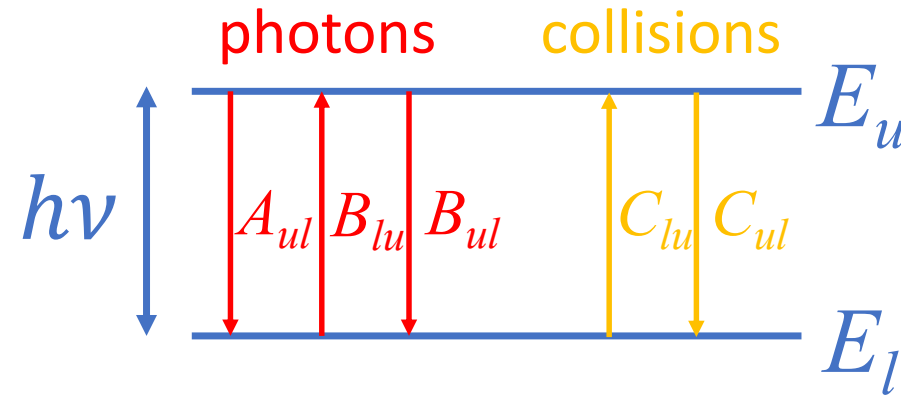*Observatoire des Sciences de l'Univers de Grenoble*

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Outline

- Scientific context
- Concept and main goals
- Next steps
- Future developments
- Demo

Context

- Interpretation of microwave and infrared line spectra from spatial missions and large telescopes

- Spectroscopy: energy levels and Einstein coefficients (determined by experiments)
- Collisions: Collision rate coefficients (determined by calculations)

Available collisional databases

Context

- LAMDA (since 2005)
  https://home.strw.leidenuniv.nl/~moldata/

- BASECOL (since 2005)
  https://basecol.vamdc.eu/collisions.html

- EXCITATION (since 2015)
  https://www.physast.uga.edu/amdbs/excitation

- CASSIS 'Collision Database' (since 2016)
  http://cassis.irap.omp.eu/?page=catalogs-collision

Why a new collision database ?

Context

- The reference database is LAMDA. But collision data are mostly produced in France !

- Failure of the transfer of BASECOL from Paris to Grenoble (septembre 2020)

- No current database is regularly updated

- New type of data: reactive species, electronic transitions, cooling functions, etc.

- Both data producers and data users are present at IPAG, responsiveness with regards to the evolution of needs

Main goals of EMAA

Concept

- Provide files directly usable for radiative transfer studies by combining collisional and spectroscopic data, i.e. user-oriented

- Associated spectroscopic databases: CDMS, JPL, HITRAN, EXOMOL

- 'Radex' file format (widely used radiative transfer code)

Implementation

Concept

- Quick access to the files

- DOI for each dataset

- Citation of articles from data producers made easy

Which data in EMAA

Concept

- Data produced by Alexandre Faure (IPAG) & close collaborators (e.g. F. Lique, J. Tennyson) in a first instance / projects supported by ANR/ERC

- The project started in October 2020

- Proof of concept online since 4th November 2021 at :

    ### https://emaa.osug.fr

- About 50 species (as of Jan. 2022)

- For comparison:
    - 50 species in LAMDA (some obsolete data)
    - 80 species in BASECOL (no spectroscopic data)
    - 10 species in EXCITATION
    - 60 species in CASSIS (some obsolete data)

Next steps

- Ask beta testers to provide feedback and suggest improvements
- Circulate to the community
- Set up a scientific committee
- Usage statistics
- Request for INSU Label next year

Foreseen developments

- Interoperability / VAMDC standards
- Several choices of data format
- Possibility to select subset of data
- New radiative transfer code to take new data into account (e.g. reactive collisions)
- Visualisation tools