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DEFINITION AND IMPLEMENTATION OF VO STANDARDS FOR THE ACCESS OF ATOMIC AND MOLECULAR LINELISTS

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Abstract. We report here our latest developments concerning the access to Atomic and Molecular Linelists Databases within the Virtual Observatories, addressing the definition of standards through a proposed Data Model (AMLDM) , an access protocol to linelists (SLAP), and their implementation on customized spectroscopic data from the CDMS/JPL databases. Currently a sub-set of CDMS data can be retrieved from BASECOL database using the SLAP protocol.

1 Atomic and Molecular Line Data Model

1.1 Introduction

The main objective of the model is to give access to the relevant information that will allow the identification and search of lines within VO environments. In the astrophysical sense, a line is considered as the result of a transition between two levels. Under the basis of this assumption, a whole set of objects and attributes have been derived to define properly the necessary information to deal with lines appearing in astrophysical contexts.

1.2 Requirements

The model must describe

- Laboratory measured and fitted linelists; this implies that the model is based on Atomic and Molecular Theoretical Spectroscopy
- Lineslists obtained from observed/simulated spectra; this requires to describe the astrophysical environment and processes that might change the attributes of the line.

Moreover the model must be precise enough in order to carry out science and general enough in order to cover observational databases. At present the model is suitable for lines arising from

- Light-Matter Interaction: bound-bound

$$A(j) + h\nu \rightarrow A(j') \quad \text{or} \quad A(j') \rightarrow A(j) + h\nu$$

- Radiative recombinaison

$$(Z, N-1) \; + \; e \rightarrow (Z, N) + h\nu$$

The complete data model can be found in a technical document (Dubernet et al. 2006) currently available under version 0.5 (30/01/2006) in the IVOA community [4] and getting close to a final version.

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2 Simple line access protocol

The purpose of the spectral line query is to allow users/clients to search in a wavelength range for spectral lines. The most basic query parameters will be the minimum and maximum value for the wavelength range. Additional parameters may be used to refine the search or to model physical scenarios.
The compulsory parameter is "WAVELENGTH (in meters)". Non-compulsory parameters are: "CHEMICAL_ELEMENT", "INITIAL_LEVEL_ENERGY (in Joules)", "FINAL_LEVEL_ENERGY (in Joules)", "TEMPERATURE (in Kelvin)", "EINSTEIN_A (in s-1)".
Moreover, the SLAP protocol can be extended at will by each service provider, by adding new query parameters. The protocol provides a mechanism that allow a client to know all the parameters a server provides. In this particular case, the client will use a request with the following parameter : "FORMAT=METADATA". Then, the client will get a XML document describing each parameter. It is up to the client to implement a way to use this document.
A technical document (Salgado et al 2006) is currently available under version 0.5 (30/01/2006) in the IVOA community (cf footnote 4) and getting close to a final version.

3 Implementation on CDMS/JPL data

We developed a software to merge CDMS [5], JPL[6] and Basecol [7] collisional data. A PHP script is used, it reads JPL and CDMS files, inserts values in a MySQL database in order to improve manipulation of data. This script deals with all the small exceptions that have been used to code quantum numbers. Even if all CDMS files have a similar format, it is necessary to check files individually as some problems occur occasionnally.
A sub-set of data are currently available and can be retrieved from BASECOL database via a SLAP protocol.

References

Dubernet, M.-L. et al. 2006, IVOA, Version 0.5, January 2006 "Atomic and Molecular Lines Data Model"
Salgado, J. et al. 2006, IVOA, Version 0.5, May 2006, "Simple Line Access Protocol"

[5] http://www.ph1.uni-koeln.de/vorhersagen/
[6] http://spec.jpl.nasa.gov/
[7] http://www.obspm.fr/basecol/