

Definition and Implementation of VO Standards for the Access of Atomic and Molecular Linelists

<http://www.ivoa.net/twiki/bin/view/IVOA/SpectralLineListsDocs>



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Atomic & Molecular Lines Data Model

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. The document has been written taking into account available information from many different Line data providers.

Requirements: The model MUST DESCRIBE:

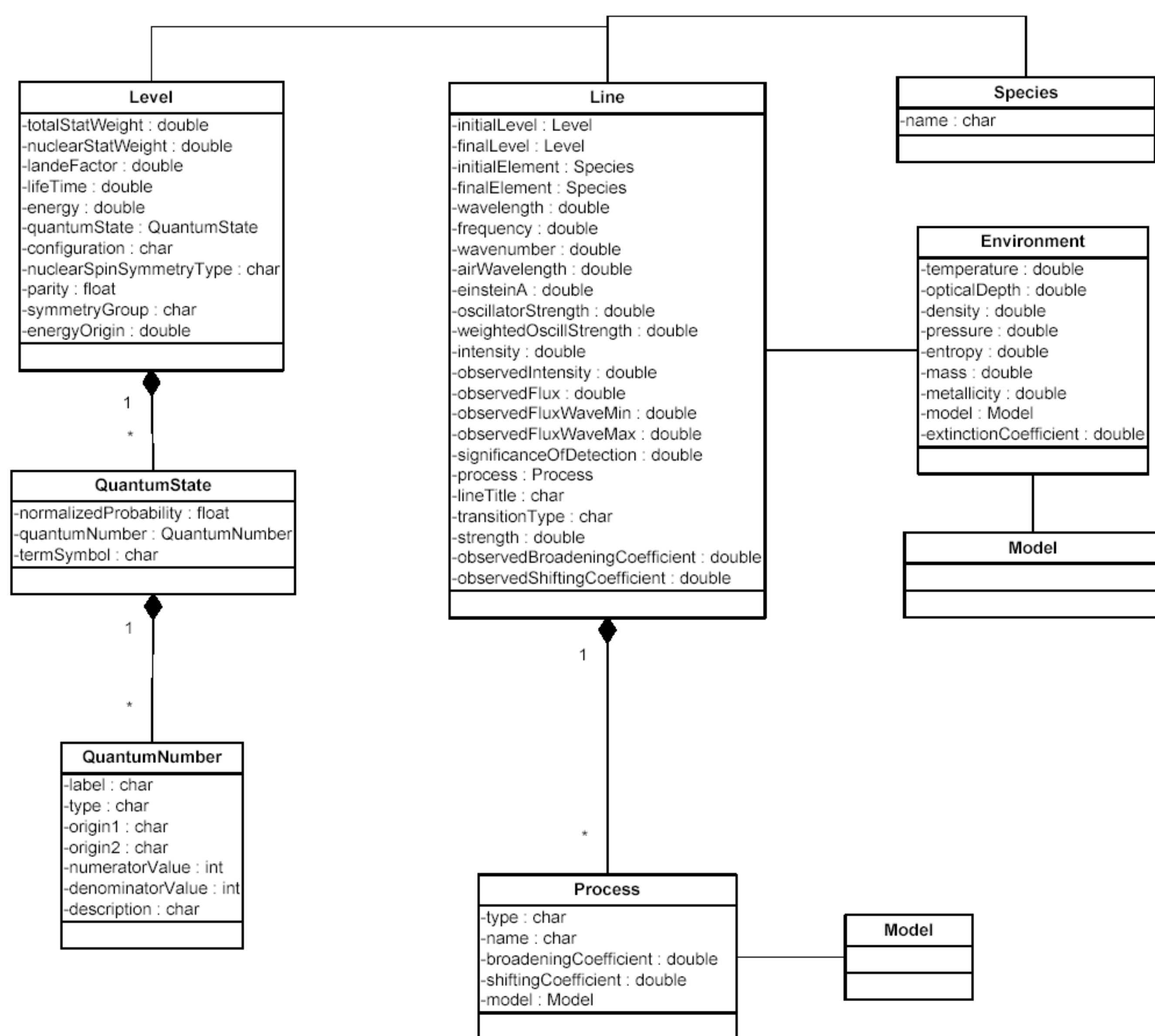
- Laboratory measured & fitted linelists
 - Based on Atomic&Molecular Theoretical Spectroscopy
- Linelists obtained from observed/simulated spectra
 - This requires to describe: Environment and Process that might change attributes of the line and where the line originates from.
- Atomic and Molecular Species
- Precise enough in order to carry out science
- Unprecise enough in order to cover observational databases

At present the model is suitable for lines arising from:

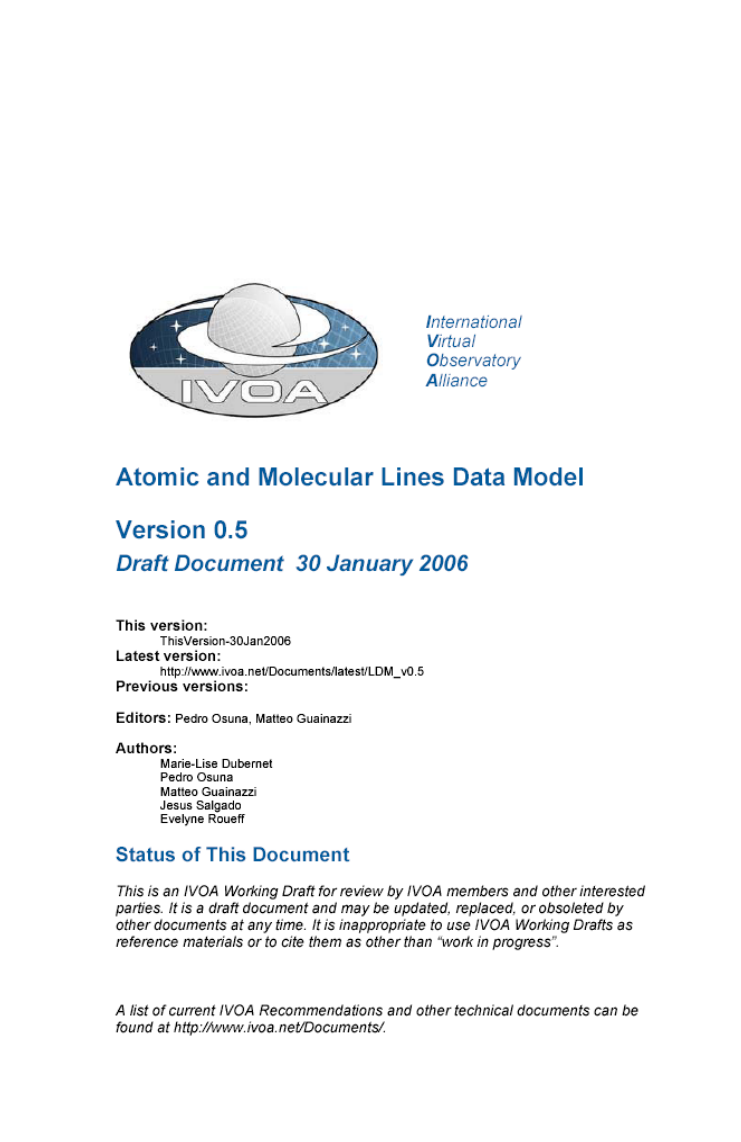
Light – Matter Interaction : bound-bound
 $A(j) + h\nu \rightarrow A(j')$ or $A(j') \rightarrow A(j) + h\nu$

Radiative recombinaison
 $(Z, N-1)[\text{level.of.Z(N-1)}] + e \rightarrow (Z, N)[\text{level.of.Z(N)}] + h\nu$

DataModel :



Documents status and perspectives



- **AML DM Current version: 0.5 (30/1/2006)**
- **circulated to the DM and DAL groups, as well as to atomic and molecular astrophysicists for comments**
- **Goal: achieve the status of a proposed recommendation in the next 4 months.**
- **Useful for ETL studies and calibration**
- **Requirements: to be implemented by the AM databases communities**

Spectral Line Query : SLAP



Simple Line Access Protocol

Version 0.5
 Draft Document 17 May 2006

This version: 0.5 17May2006
 Latest version: <http://www.ivoa.net/Documents/latest/version-name>
 Previous version(s):

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Abstract

This specification defines a protocol for retrieving spectral lines from different spectral line databases through a uniform interface.

Document status

- **Goal: achieve the status of a proposed recommendation in the next 4 months.**

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.

Compulsory parameter :

- > WAVELENGTH (in meters)

Non-compulsory parameters :

- > 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. :

```

<RESOURCE type="results">
  <DESCRIPTION>IASD Simple Line Access Service</DESCRIPTION>
  <INFO name="QUERY_STATUS" value="OK"/>
  <PARAM name="INPUT:WAVELENGTH"
    ucd="em.wl" utype="ldm:Line.wavelength" value="30">
    <DESCRIPTION> Specify the wavelength spectral range. To be specified in
    meters. This wavelength will be interpreted as the wavelength in the vacuum of
    the transition originating the line
  </DESCRIPTION>
  </PARAM>
  <PARAM name="INPUT:OBSNO" ucd="obs.id">
    <DESCRIPTION> Specify the ISO observation number where this line has
    been identified
  </DESCRIPTION>
  </PARAM>
  
```

AMLDM and SLAP are a collaborative project between Paris VO Data Center and ESAC supported by several organizations :

- > ACI MDA, Programme National PCMI
- VOFrance, Scientific council of Paris Observatory, LERMA

Currently: Extended Data Model for Atomic and Molecular Data

An effort has started at NIST to describe all processes concerning atomic physics.

Through a collaboration between NIST, IAEA, Oackridge, NIFS and Paris Observatory, their DM is going to be extended to molecular physics

