SLAP2

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What is SLAP ?

- a protocol for retrieving spectral lines coming from various Spectral Line Data Collections
- lines can be either observed or theoretical
- used to identify emission or absorption features in astronomical spectra.
- SLAP 1 comes with an associated data model : the Simple Spectral Lines Data Model (SSLDM)
- SLAP 1 and SSLDM are both 2010 recommendations
- Only a few services have been implemented

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Origin of SLAP2

- Conclusions of 2016 Interop in Trieste :
  - Convergence between VAMDC and IVOA standards for spectral lines search
  - VAMDC will provide a SLAP output for its services
  - SLAP needs to be completed :
    - More emphasis on data references (it was absent from SSLDM)
    - Metadata about query execution
    - Listing available species

State of spectral lines protocols in 2025

- SLAP 2 was put on hold in 2020 and LineTap was proposed : a simpler protocol based on TAP without a full data model
- In 2025 we have two propositions but no recommendation
- DAL meeting in May to take a decision :
  - Conclusions :
    - Both protocols can cover the same use cases
    - We will keep SLAP2 with a LineTap approach : no underlying data model
    - Extend the /species endpoint of SLAP2 with more search possibilities (it simply returned a list of species)

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SLAP2 endpoints

- /capabilities (mandatory)
- /availability (optional)
- /examples (optional)
- /lines (mandatory)
- /species (mandatory)

/lines endpoint mandatory parameters

- 2 mandatory parameters:
  - WAVELENGTH (in meters) a wavelength interval to look for spectral lines
  - MAXREC : maximum number of returned lines

Some **/lines** endpoint optional parameters

- Restriction on species:
  - CHEMICAL_ELEMENT :
    - For an atom : atom symbol
    - For a molecule : name (water) or formula (H2O)
  - INCHIKEY : a 27 character long identifier (standard of International Chemical Union)
    - example for water : InChI=1S/H2O/h1H2 -> XLYOFNOQVPJJNP-UHFFFAOYSA-N

Some **/lines** endpoint optional parameters

- SPECIES_MASS (in atomic mass unit) : restriction on atom or molecule mass
- ION_CHARGE : restriction on species charge
- LOWER_LEVEL_ENERGY, UPPER_LEVEL_ENERGY (in Joules) : energy of the lower and/or upper state of the transition

Mandatory output fields

- vacuum_wavelength (in meter) : wavelength in vacuum for the transition originating the line
- line_title : a short description identifying the line, can be used by a client for display purpose
  - Ex : H I, N III 992.873 A

Optional output fields for species characterization

- chemical_element_name : conventional molecule name (CO2, CH4) or atom symbol
- inchi
- inchikey
- chemical_element_mass (in unified atomic mass unit) : species mass
- ion_charge : species charge

Optional output fields for level characterization

- lower_level_description / upper_level_description : a full description of the level (can be used for display, can contain the quantum numbers)
- lower_level_energy/upper_level_energy (in Joules)
- lower_level_configuration/upper_level_configuration : electronic configuration
- lower_level_quantum_numbers/upper_level_quantum_numbers : quantum state of the level
  - Example : [J:1:1,F1:0:0,F:1:1] (label:numerator:denominator)
  - In case a user need a detailed description of the quantum numbers, the same spectral query can be submitted to VAMDC

Optional output fields for references

- reference_doi : a DOI pointing to the paper describing the data
- reference_uri : a http link pointing to a scientific publication
- reference_additional_uri : extra informations related to the spectral line

Result metadata

- Metadata are added to the result VOTABLE in INFO fields to identify data provenance and simplify comparison between tables (taken from Data Origin note)
- request_date : date when query was executed (ISO 8601)
- service_protocol : ivoid of the service protocol
- publisher : data center that published the VOTABLE
- last_update_date : last data update date
- query : query originating this VOTABLE

Result metadata

- Suggestion :
  - adding **service_ivoid** to the query information table in Data Origin
  - It would contain the ivoid of the service that returned the votable
  - It would complete the **ivoid** field described as “IVOID of underlying data collection”

The **/species** endpoint

- Provides a way to get all the species available in a service
- Can be used by client to build an interface for example
- Simplifies search of spectral lines by species :
  - Molecule names and formulas can be ambiguous
  - With the /species endpoint, one can discover what is available and use inchikey for better identification
  - Equivalent of “select species” provided by all the VAMDC nodes

The **/species** endpoint parameters

- All query parameters are optional
- ELEMENT_TYPE : atom or molecule
- INCHIKEY : to test the existence of a given inchikey
- Element search parameters:
  - CHEMICAL_ELEMENT_NAME_STARTSWITH, CHEMICAL_ELEMENT_NAME_CONTAINS
    - CHEMICAL_ELEMENT_NAME_STARTSWITH=CH2 -> CH2, CH2DCN, CH2NH …
  - STOICHIOMETRIC_FORMULA_STARTSWITH, STOICHIOMETRIC_FORMULA_CONTAINS
    - STOICHIOMETRIC_FORMULA_STARTSWITH=CH2 -> CH2, CH2N, CH2N2 …

The **/species** endpoint output fields

- chemical_element_name
- chemical_element_type
- chemical_element_stoichiometric_formula
- ion_charge
- inchi
- inchikey

Next steps

- New corrections submitted in a few days
- Document review by a field expert
- Implementation of modifications in the VAMDC node software