FAIR approach for Low Frequency Radio Astronomy

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The MASER (Measuring, Analysing and Simulating Emissions in the Radio range) is an **Open Science** and **Science Ready** tool box for **low frequency radio astronomy**.

It provides access to several data collections recorded with ground and space instrumentation (Nançay, Cassini, Wind, STEREO, Juno...). The tool box includes a data discovery interface (VESPA network), a data streaming interface (das2 servers), a modelling tool for planetary radio emissions, a dedicated data access python library, as well as a new ecosystem developed to store, annotate and share catalogue of events in the temporal-spectral domain (TFCat format and library). We present examples and use cases for various data collections.

https://maser.lesia.obspm.fr

MASER

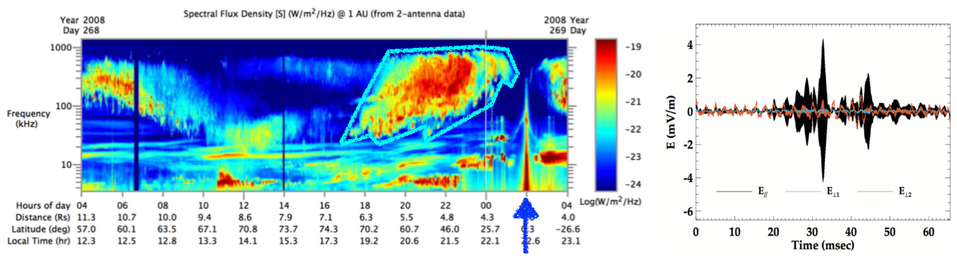
Why and for whom?

- Low frequency radioastronomy:
  - large collections (long time scales and/or high resolution…)
  - event/features not always predictibles (sporadic, intermittent…)

- Users needs:
  - **discovery** of datasets
  - online access for **visualisation**
  - python library for **programmatic access**
  - **annotation and sharing** of event/feature catalogues
  - **hosting** datasets

Data product types

- Mostly **spectrograms (aka dynamic-spectra)**. Measured parameter (flux, polarization…) depending on time and frequency.
- Sometime: "**waveform**" (direct sampling of electric signal temporal fluctuations). Much higher data rate needed.
- also, **events**. timestamp + label + parameters (coverage) + data ? waveform snapshot can be considered as an event.
- and **catalogues** of events/features
- NB: *imaging data not in the scope of MASER*



Interfaces

- **IVOA**:
  - EPN-TAP (solar system data discovery)
  - TAP (tabular data access): 2 servers (PADC: http://voparis-tap-maser.obspm.fr, CDN: http://vogate.obs-nancay.fr)
  - Datalink (linking between data, quicklook, access)
  - UWS (run on demand): 1 server, https://voparis-uws-maser.obspm.fr/client/
  - IVOA registry

- **IHDEA**:
  - das2: data streaming, 2 servers (PADC: http://voparis-das-maser.obspm.fr/das2/server, CDN: https://das2server.obs-nancay.fr/das2/server)
  - CDF-ISTP (format)
  - SPASE registry

- **DOI**:
  - publishing collections (https://maser.lesia.obspm.fr/publications/doi/)
  - landing page with schema.org

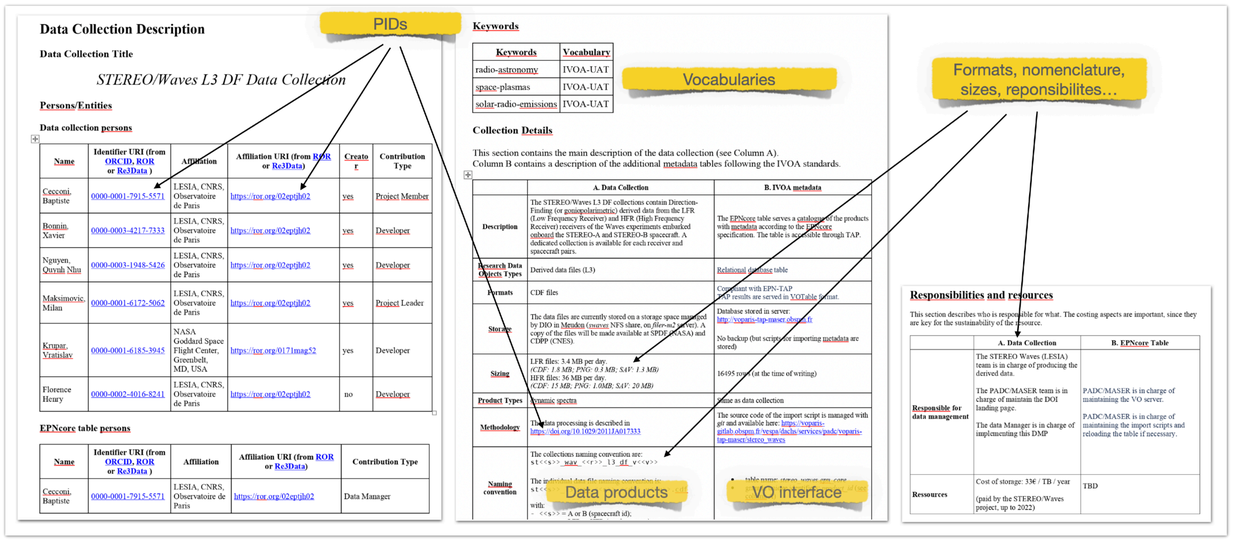
- **Other**:
  - TFCat (Time-Frequency Catalogue) https://gitlab.obspm.fr/maser/catalogues/tfcat
  - WebGeoCalc (local instance of WGC/SPICE server developed by NASA/JPL)

Technologies/standards landscape

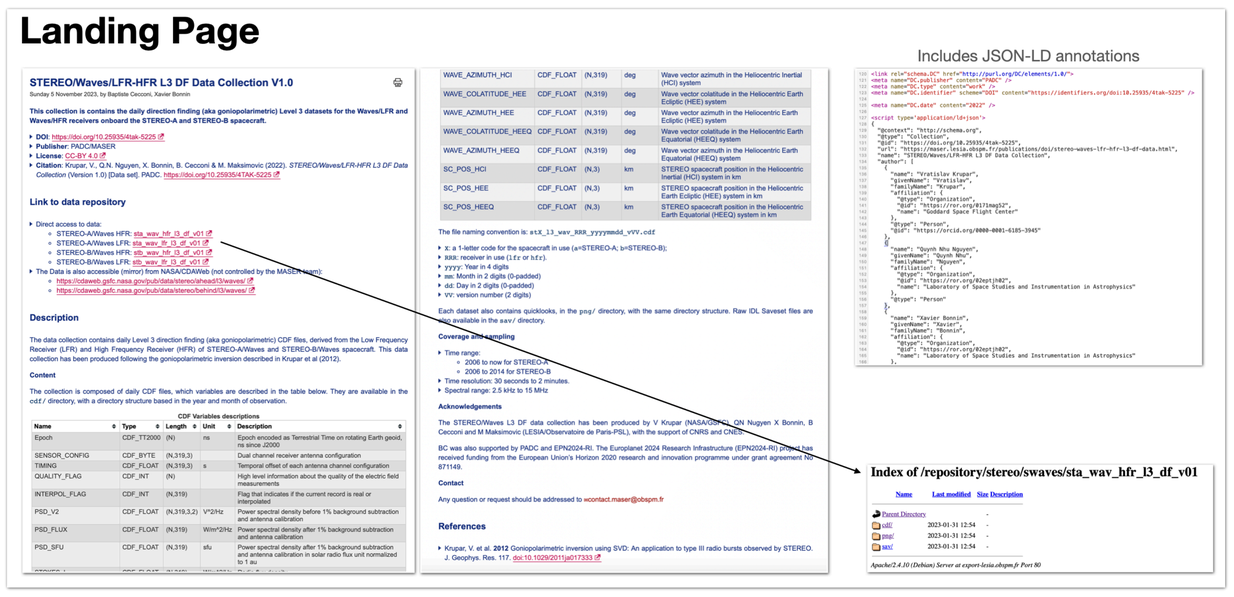
- **Several ecosystems** (different communities):
  - **IVOA** (International Virtual Observatory Alliance) http://ivoa.net
    ⇒ ***interoperability driven*** (schemas, protocols, vocabularies)
  - **IPDA** (International Planetary Data Alliance) https://ipda.jpl.nasa.gov
    ⇒ ***archive driven*** (information model based on OAIS)
  - **IHDEA** (International Heliophysics Data Environment Alliance) https://ihdea.net
    ⇒ ***(re)use driven*** (data/metadata formats, protocols, tools)
  - **Datacite** (DOI) https://datacite.org
    ⇒ ***reference driven*** (reference, citation, related resources)

DMP & Persistent Identifiers

- **Why?**
  - define the structure of collections
  - select interoperable interfaces, standard formats (e.g., FITS, CDF…)
  - empowering teams
  - plan storage needs
  - required by many funders
- **What?**
  - describe collections and interfaces (EPN-TAP, das2)
  - responsibilities: scientific content maintenance, storage maintenance, VO interfaces maintenance



Landing Page



- **Allowing Data Citation** of collections, supplementary materials, catalogues…
  => pushing editors to make it right is difficult
  => most editors don't do the last step (on Crossref API)

- Working with NASA/ADS and IVOA to try to find a way to complement the citation knowledge graph, from the data provider's side

Summary

- Currently MASER = solar system radioastronomy (starting of official operation in Jan 2022) possible extension to transient low frequency radio astronomy

- IVOA integration:
  - **EPN-TAP** + **Datalink** 👍
    => search engine for local data management tools
    => data discovery
  - **UWS** works very well for run-on-demand

- Community Specific:
  - **Das2**: data streaming interface for dynamic spectra
  - **TFCat** for event/feature catalogues

- Implementation of FAIR principles + open policies.
  Pushing for data citation and references, but difficult force editors to do their work…

References

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