



VIRTUAL ASTRONOMICAL OBSERVATORY

SED Data Model and Access Protocols

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Use Cases

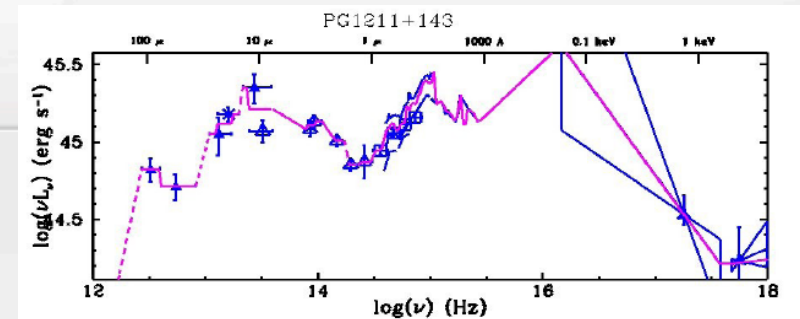
- SED View/Analysis
 - Discover, retrieve, display computed SED
 - Quantitative/interactive analysis, template fitting
- SED Editing
 - Fetch and edit an existing computed SED
 - Turn data on/off, add new data
- SED Builder
 - Discover, retrieve observational data
 - Apply algorithm, knowledge to compute SED



SED Data Model

- Uniform SED

- Uniform view of photometric data points from multiple observations
 - Presents overall/combined SED with uniform spectral and flux units
 - Can be viewed as a type of Spectrum
- *Rebinned* SED is a special case of a uniform SED
 - Combines any overlapping segments/observations



- Aggregate SED

- A set of "segments", one for each contributing observation
 - Permits full characterisation of each observation
- Used by a SED builder tool to build the overall/uniform SED
- Allows editing of an existing uniform SED



SED Data Model

- A SED instance is either
 - A single "segment" (the uniform or binned SED)
 - An aggregation of segments
 - Mapping of SED data points to segments can be complex

- Segments of aggregate SED can be
 - Single photometry point
 - Time series or light curve
 - Spectrum



SED Segments

- Spectrum
 - Spectrum is described directly by the Spectrum DM
 - Spectrum 1.2 DM integrates Photometry DM (allows fluxing)
- Time Series
 - Time series is an extension of Spectrum DM
 - Light curve is a time series with one photometric band
- Photometric point
 - Limiting case of light curve with single data point
 - Often derived from an image
 - hence addition of aperture correction support in Spectrum 1.2



SED Metadata

- Dataset metadata
 - Describes entire VO Dataset, e.g. for discovery, characterisation
 - SED-specific metadata
 - *Dataset type, DataModel, SED length, nSegments, sedAggregate* URI, etc.
 - Also generic Dataset metadata for overall SED

- Data point metadata
 - Describes a data point in the uniform SED
 - Some summary segment-related metadata

- Custom metadata
 - Provided by data provider or SED builder application
 - Describes specific algorithm/process used to compute uniform SED

Data.segmentType	One of “photometry”, “timeseries”, “spectrum”, or “composite”.
Data.segments	The segment number, a comma-delimited list of segment numbers, or NULL if a more complex combination of segments are used to compute the given photometric value. The uniform SED is segment zero.
Data.Target.pos	The published observed position in the dataset reference frame.
Data.DataID.bandpass	The spectral bandpass (filter or bandpass name).
Data.DataID.title	Brief description of the data point or segment.
Data.SpectralAxis.value	Spectral coordinate for data points.
Data.SpectralAxis.publishedValue	The spectral coordinate of the original published observation in the same units as Data.SpectralAxis.Value.
Data.FluxAxis.value	Computed flux value for data point.
Data.FluxAxis.Accuracy.statError	Statistical error for flux value (see Spectrum for additional options to specify errors).
Data.FluxAxis.publishedValue	The original published flux value.
Data.FluxAxis.Accuracy.publishedStatError	The statistical error of the original published flux value.
Data.FluxAxis.publishedUnit	The unit for the published flux value and error.
Data.comments	Additional information about the computed data value or segment.



SED Serialization

- Science data formats
 - VOTable, FITS

- VOTable option can contain
 - Uniform SED
 - single table
 - Aggregate SED
 - set of tables, one per segment
 - Both Uniform and aggregate SED in one file
 - useful to not only view but understand or edit uniform SED



SED Data Access

- Need comprehensive approach
 - SED, 1D spectra, and time series are all closely related
 - Variants of SSA access protocol will work for all
 - however there are differences

- Status
 - Good progress on approach for this in DAL/DM over past week



SED Data Access

- Consensus suggests separate protocols
 - SED, Spectrum, TimeSeries share common data model
 - However they are distinct classes of data to an astronomer
 - Data access is not just data models, but access *methods*
 - How data is used for analysis is quite specific to class of data
- Examples
 - SSA requires line cutout, spectral extraction from cube, etc.
 - SED requires search by target name, access to uniform or aggregate SED, concepts not relevant to 1D spectra
 - Query response differs for each type of data
 - Services must be registered by service class for each type of data



SED Access Protocol

- Variant on SSA access protocol
 - Query parameters largely the same
 - Query by target name is mandatory for this data
 - Query response requires some changes to describe SEDs
- Access semantics
 - Can retrieve uniform SED, aggregate SED, or perhaps both
 - Primary output formats
 - VOTable, FITS; CSV/TSV, graphics, HTML (uniform SED)

