Spectrum and SSA V1.2 Update and thoughts about time series

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Spectrum 1.2

- Motivation
  - Integrate PhotDM to support SED, time series
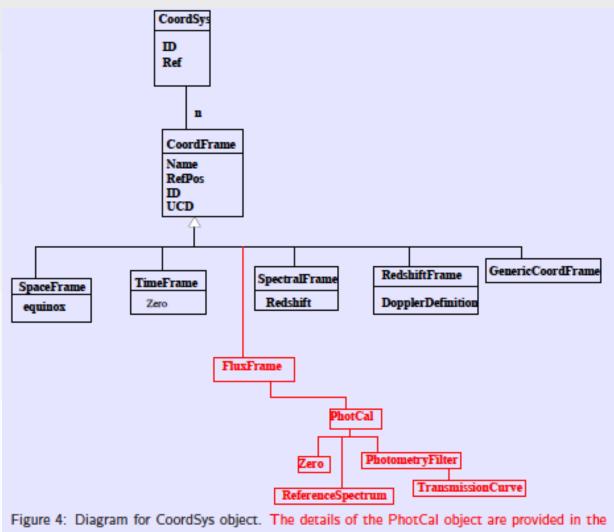 - Minor issues were already updated in Spectrum 1.1

- What has changed
  - Mainly addition of photCal component data model
  - Support for aperture correction (mainly for SEDs)

PhotCal Element

Figure 4: Diagram for CoordSys object. The details of the PhotCal object are provided in the IVOA Photometry Data Model standard.

Table 1: Spectrum metadata fields

Field	FITS	UCD1+	Meaning	Req
DataModel	VOCLASS		Data model name and version	MAN
Type	VOSEGT	Dataset or segment type	OPT	Spectrum
Length	DATALEN	meta.number	Number of points	OPT
TimeSI	TIMESDIM	time;arith.zp	SI factor and dimensions	REC
SpectralSI	SPECSDIM	-	SI factor and dimensions	REC
FluxSI	FLUXSDIM	-	SI factor and dimensions	REC
CoordSys.ID	VOCSID		ID string for coordinate system	OPT
CoordSys.SpaceFrame.Name	RADECSYS		ICRS or FK5	REC
CoordSys.SpaceFrame.UCD	SKY_UCD	-	Space frame UCD	OPT
CoordSys.SpaceFrame.RefPos	SKY_REF		Origin of SpaceFrame	OPT
CoordSys.SpaceFrame.Equinox	EQUINOX	time.equinox;pos.frame	Equinox	OPT
CoordSys.TimeFrame.Name	TIMESYS	time.scale	Timescale	OPT
CoordSys.TimeFrame.UCD	-	-	Time frame UCD	OPT
CoordSys.TimeFrame.Zero	MJDREF	time;arith.zp	Zero point of timescale in MJD	OPT
CoordSys.TimeFrame.RefPos	-	time.scale	Times of photon arrival are at this location	OPT
CoordSys.SpectralFrame.Name	SPECNAME	-	Spectral frame name	OPT
CoordSys.SpectralFrame.UCD	TUCDn	-	Spectral frame UCD	OPT
CoordSys.SpectralFrame.RefPos	SPECSYS	?	Spectral frame origin	OPT
CoordSys.SpectralFrame.Redshift	REST_Z		If restframe corrected	OPT
CoordSys.FluxFrame.Name	PHBAND	instr.bandpass	Name for band	OPT
CoordSys.FluxFrame.ID	PHID	meta.ref.ivorn	URI for PhotCal definition	OPT
CoordSys.FluxFrame.UCD	PHUCD	meta.ucd	UCD for PhotCal definition	OPT
CoordSys.RedshiftFrame.Name	ZNAME	-	Redshift frame name	OPT
CoordSys.RedshiftFrame.DopplerDefinition	TCTYPnZ	-	Opt, Radio, or Rel.	OPT
CoordSys.RedshiftFrame.RefPos	SPECSYSZ	-	Redshift frame origin	OPT
Curation.Publisher	VOPUB	meta.curation	Publisher	MAN
Curation.PublisherID	VOPUBID	meta.ref.url;meta.curation	URI for VO Publisher	OPT
Curation.Date	VODATE		Date curated dataset last modified	OPT
Curation.Version	VOVER	meta.version;meta.curation	Version info	OPT
Curation.Rights	VORIGHTS		Restrictions: public, proprietary, mixed	REC
Curation.Reference	VOREF	meta.bib.bibcode	URL or Bibcode for documentation	REC
Curation.Contact.Name	CONTACT	meta.bib.author;meta.curation	Contact name	OPT
Curation.Contact.Email	EMAIL	meta.ref.url;meta.email	Contact email	OPT
Curation.PublisherDID	DS_IDPUB	meta.ref.url;meta.curation	Publisher's ID for the dataset ID	REC
Correction.FluxAxis.ApFrac.Value	APFRAC	arith.ratio	Aperture fraction 0 to 1	OPT
Correction.FluxAxis.ApFrac.Applied	APFAPP	meta.code	Aperture fraction applied	OPT

PhotCal Model

Field	FITS	UCD1+	Meaning
Spectrum.CoordSys.FluxFrame.PhotCal photometric calibration fields			
PhotCal.UniqueIdentifier	PHUID	meta.ref.ivorn	Unique ID for band
PhotCal.referenceMagnitude.Value	PHMAGZ	phot.mag	Zero point reference mag
PhotCal.referenceMagnitude.Unit	PHMUNI	meta.unit	Unit for ref mag
PhotCal.referenceMagnitude.UCD	PHMUCD	meta.ucd	UCD for ref mag
PhotCal.ZeroPoint.Flux.Value	PHZERO	phot.flux.density	Flux density at ref coord
PhotCal.ZeroPoint.Flux.Unit	PHFUNI	meta.unit	Unit for flux density
PhotCal.ZeroPoint.Flux.UCD	PHFUCD	meta.ucd	UCD for flux density
PhotCal.ZeroPoint.Type	PHFTYPE	meta.code	Type of zero point
PhotCal.ZeroPoint.softeningCoefficient	PHFLUPB	obs.param	Lupton b coefficient
PhotCal.MagnitudeSystem.ReferenceSpectrum	PHREFS	meta.ref.ivorn	URI for Reference spectrum
PhotCal.MagnitudeSystem.Type	PHMSTY	meta.code	Code for reference spectrum type
PhotCal.PhotometryFilter.filterName	PHNAME	instr.bandpass	Name for band
PhotCal.PhotometryFilter.BandName	PHGID	instr.bandpass	Generic name for band
PhotCal.PhotometryFilter.filterDescription	PHDESC	meta.note	Description of band
PhotCal.PhotometryFilter.fpsIdentifier	FPSID	meta.ref.ivorn	FPS ID, if needed
PhotCal.PhotometryFilter.filterTransmissionCurve	PHTRANS	meta.ref.ivorn	URI for Transmission curve

SSA 1.2 and Data Models

- Spectrophotometric Data
  - Spectrum, TimeSeries and SED are closely related
    - Top level Dataset classes in DAL
    - Top level objects in ObsTAP (*dataproduct_type*)
  - At "Dataset" level SSA, SED, TS are distinct

- Data models
  - "Spectrum" data model (rename?) is the core
    - Immediately useful for spectra
  - SED model uses Spectrum for "segments"
    - observations and uniform SED
  - TimeSeries extends the Spectrum model
    - Light curve and photometry point are limiting cases

SSA 1.2 (and so forth)

- Role of SSA 1.2
  - Continue to limit to 1D spectra?
  - If so changes required for 1.2 are probably fairly minor
  - Most new requirements can be met with SED and TS protocols

- Case for separate SSA/SED/TS protocols
  - Data model *is* largely common
  - But data access semantics differ
    - How data is used for research, analysis differs considerably
    - 1D spectrum, SED, time series differ at user level
  - Access protocols largely similar, but differ in access methods
    - Some differences in data models, metadata, virtual data generation
    - Even if they were identical we need to register by class of data

SSA 1.2

- Scope
  - Baseline is a minor update to reflect integration of Photometry DM
  - Consistency with new SED and time series protocols

- Features
  - Possible to add new features unique to spectral access
    - Anything major should probably be deferred to 2.0
    - 1D spectrum access tweaks or features are possible (what?)
    - A 1.2 version needs to be backwards compatible
  - Support for SED, TS is best handled by separate protocols
    - Makes it much easier to add new features
    - Backwards compatibility not an issue

Time Series

- ## Data Model
  - Spectrum 1.2 is the core
    - Extended for time series (similar to SED)
  - "Dataset" element contains TS-specific metadata
    - Period information, indication if folded, object classification etc.
  - PhotCal
    - Describes photometric bands
    - May be multiple instances for multiband photometry
    - Data references band ID

- ## Access Protocol
  - Very similar to SSAP; different registry extension/class
  - Need to explore analysis req for TS, e.g. periodogram support