



Unified Content Descriptors for Planetary Sciences and Heliophysics

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Context

- ❖ Europlanet / IDIS: prototyping a Planetary Sciences VO
HELIO: Heliophysics Integrated Observatory
- ❖ Several of science thematics: *Sun, planets, atmospheres, surfaces, interiors, small bodies, orbital parameters, in situ exploration, plasma (waves, particle and fields), radio astronomy...*
- ❖ Large variety of data types: *images, spectra, times series, movies, dynamic spectra, profiles, maps...*
- ❖ Even larger variety of physical parameters
- ❖ Including: *remote data, in-situ data, models, lab experiments, field analogs*

UCDs

Unified Content Descriptors

- ❖ IVOA recommendation:
<http://www.ivoa.net/Documents/latest/UCD.html>
- ❖ From this recommendation:
 - UCD = «A Controlled Vocabulary for Astronomy»
 - *A UCD does not define the units nor the name of a quantity, but rather "what sort of quantity is this?"; for example phys.temperature represents a temperature, without implying a particular unit.*
- ❖ IVOA UCD List:
<http://www.ivoa.net/Documents/latest/UCDList.html>
- ❖ *A UCD is a string which contains textual tokens called 'words', separated by semicolons(;). A word is composed of 'atoms', separated by periods(.). The hierarchy is as follows:
atoms → words → composed words
UCD1+ are either single words, or a composition of several words.*

UCD Tree Structure

12 main categories

* **arith** (arithmetics)

This section includes concepts involving or indicating some mathematical operation performed on the primary 'concept' or just the presence of an arithmetic factor or operator.

* **em** (electromagnetic spectrum)

This section describes the electromagnetic spectrum, either in a monochromatic way or in predefined intervals. The complete list of proposed bands (in seven classical regions of the e.m. spectrum: radio, millimeter, infrared, optical, ultraviolet, x-ray and gamma-ray), can be found in the document [Note-EMSpectrum-20040520](#).

* **instr** (instrument)

This section includes all quantities related to astronomical instrumentation, e.g. detectors (plates, CCDs, etc.), spectrographs, and telescopes (including observatories or missions), etc.

* **meta** (metadata)

This section includes all the information that is not coming directly from a measurement, and information that could not be included in other sections.

* **obs** (observation)

In principle under this section should go all words describing an observation (the name of the observer or PI, the observing conditions, the name of the field). In practice, the section is very 'thin' and could be deleted, if the sparse content could be housed elsewhere.

* **phot** (photometry)

All the words describing photometric measures are included in this section. The definitions distinguish between a flux density (flux per unit frequency interval), a flux density integrated over a given e.m. interval (flux if expressed linearly, mag if expressed by a log), or a flux expressed in counts/s (if the setup of the detector is photon counting observing mode). 'Colors', which are differences of magnitudes (i.e. ratios of fluxes) measured in different bandpasses, are also included.

* **phys** (physics)

This section includes atomic and molecular data (mainly used for spectroscopy) and basic physical quantities (temperature, mass, gravity, luminosity, etc.)

* **pos** (positional data)

This section describes all quantities related to the position of an object on the sky:

- Angular coordinates, and projections from spherical to rectangular systems.
- Angular measurements in general (the angular size of an object is in this section, its linear size is in the phys section).
- The WCS FITS keywords.

* **spect** (spectral data)

For historical reasons, photometric data taken in narrow spectral bands with instruments called spectrographs are classified as spectroscopic data. These definitions should not be confused with those in the em category. em represents the independent variable, or dispersion axis, and phot and spect describe the dependent variable, or flux axis.

* **src** (source)

This is a rather generic section, mainly devoted to source classifications. Variability, orbital, and velocity data are also included in this section.

* **stat** (statistics)

This section includes statistical information on measurements.

* **time** (time)

Quantities related to time (age, date, period, etc.) are described in this section.

UCD Tools

CDS UCD Builder


- ❖ <http://cds.u-strasbg.fr/UCD/cgi-bin/descr2ucd>

UCD builder

cds.u-strasbg.fr/UCD/cgi-bin/descr2ucd

forums Mission CDPP Cassini STEREO Webmail Banques Revues English YT->MP4 DOI >>

Recommendation - An IV... IVOA Document Template UCD resolver UCD builder



Use this interface to find the UCD corresponding to a description:

Enter a description in natural language:

Clear Form
Reset Form

mean electron temperature Build UCD

Last updated Tue Oct 21 17:35:31 2008

Suggested complete UCD: **phys.temperature.electron;stat.mean**

Refine your search:
The following words matched your query. You might force the selection of words matching precisely your query, and rebuild a UCD using these words:

Clear Form Reset Form

word	definition	flag	score
<input type="checkbox"/> phys.temperature.electron	Electron temperature	Q	40
<input type="checkbox"/> phys.temperature	Temperature	Q	25
<input type="checkbox"/> phys.temperature.effective	Effective temperature	Q	25
<input type="checkbox"/> phot.antennaTemp	Antenna temperature	E	15
<input type="checkbox"/> spect.line.intensity	Line intensity	E	15
<input type="checkbox"/> phys.electron.degen	Electron degeneracy parameter	Q	15
<input type="checkbox"/> stat.mean	Mean, average value	S	30
<input type="checkbox"/> phys.electron	Electron	S	15

Rebuild UCD using selected words.

Afficher un menu

UCD Tools

GAVO UCD Resolver

- ❖ <http://dc.zah.uni-heidelberg.de/ucds/ui/ui/form>

The screenshot shows a web browser window titled "UCD resolver" with the URL dc.zah.uni-heidelberg.de/ucds/ui/ui/form. The page features the GAVO logo and a navigation menu with items like "Help", "Service info", and "Related". The main content area displays a table of UCDs with descriptions similar to the one provided. The table has four columns: "Score", "UCD", "Explanation", and "Known descr.". Each row includes a "Show known descriptions" button.

Score	UCD	Explanation	Known descr.
■	phys.temperature;phys.electron	Electron of temperature	Show known descriptions
	meta.id	Identifier, name or designation	Show known descriptions
	phys.temperature.electron;phys.electron	Electron of electron temperature	Show known descriptions
	spect.line.eqWidth	Line equivalent width	Show known descriptions
	phys.temperature	Temperature	Show known descriptions
	spect.line.width	Spectral line fwhm	Show known descriptions
	stat.error	Statistical error	Show known descriptions
	phys.temperature.electron;obs.field;phys.electron	Electron of electron temperature in region covered by the observation	Show known descriptions
	phys.temperature.effective;stat.mean	Mean, average value of	Show known descriptions

UCD Proposition Website

- ❖ <http://cdsweb.u-strasbg.fr/UCD/cgi-bin/comment/ucdComments>

Comments on UCDs

You can leave on this page feedback on UCDs.
For example, suggest the creation of new UCDs, or propose to modify or remove existing ones.
The comments on this page can be reviewed and commented by people from the UCD steering committee, but other contributors are welcome. These contributions will be used to gradually improve the UCDI+.

Please check first the [existing list](#) of UCDI+.

- Click on the <Answer> button to vote (for or against) existing suggestions.
- [Click here](#) to add a new comment on this page.

The last comments are listed below. Green backgrounds are for suggested new UCDs, orange corresponds to modifications, and red to suppressions.
You can reload this page, sorting contributions by

2006/02/20 - email redirection temporarily disabled while fixing automated robot submission problem!

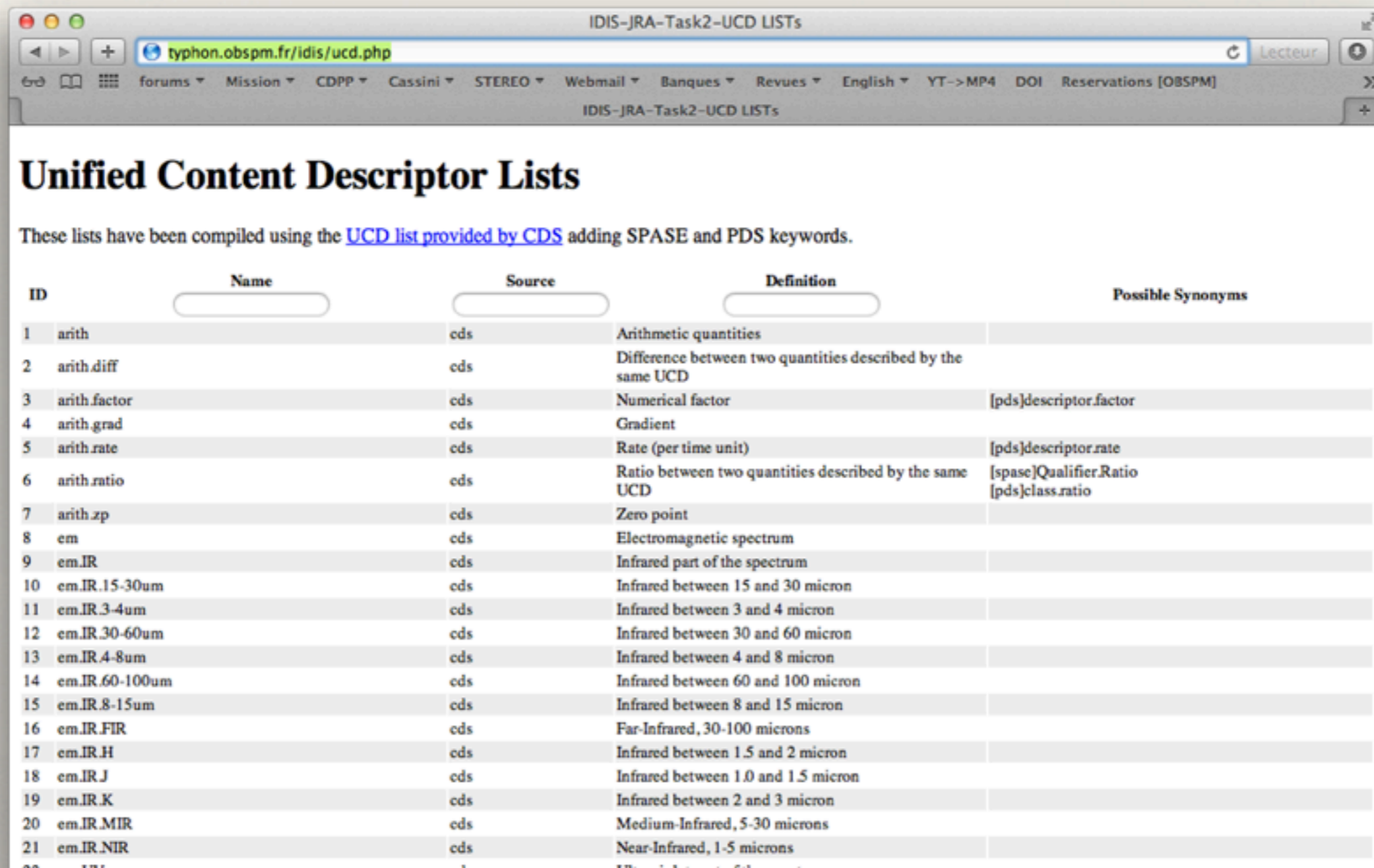
UCD	Definition	Remarks	Sugg. by	Date	Answer
time.frame	Time frame used for a time measure	This is used in Spectrum DM. Useful for Characterization too.	Sebastien Darnier	2011/10/17 07:17:33	<input type="button" value="Answer"/>
spect.continuum	Continuum spectrum (model or observed)	Often people will publish a fit to the continuum component of a spectrum with lines omitted. This UCD is the obvious counterpart to spect.line and I would like to include it in the IVOA Spectrum model.	Jonathan McDowell	2006/10/22 14:19:55	<input type="button" value="Answer"/>
pos.htm	Hierarchical Triangular Mesh Index	AFAIK, HTM is defined such that all HTM indices can have the same UCD, but it would be good to check this point with someone who understands the system properly.	Guy Rixon	2005/03/24 15:02:15	<input type="button" value="Answer"/>
phys.IMF	Initial mass function	Description of the Initial Mass Function. Note: Although it would include something like phy.IMF.mass.max, phy.IMF.mass.min for the mass limits, phy.IMF.powerlaw.slope for a powerlaw IMF, phy.IMF.lognormal.mean for the mean value of a lognormal IMF etc... I think that additional extensions would be difficult, since the IMF would use any functional form, so the UCD would refer to string values (may be it should be used with a "meta" word). Analogously, I suggest to change phy.SFR to phy.SFH (Star Formation History): SFR assumes a functional form or the star formation (a constant star formation history). SFH is more general	Miguel Cerviño	2004/12/27 12:21:40	<input type="button" value="Answer"/>
stat.moment.nth	nth moment of a statistical distribution	Such UCD would replace stat.variance and stat.mean by stat.moment.2nd and stat.moment.1st and allows to define additional moments to any statistical distribution like the measure skewness (stat.moment.3rd) or the kurtosis (stat.moment.4th) by the price of add an atom to the word. (Formally, skewness or kurtosis would imply and additional ratio operation with stat.moment.2nd, that I do not know how it can be solved in the current UCDI+. A technical note: it would be simpler to use stat.moment.2nd for variance, stat.moment.1st for mean.	Miguel Cerviño	2004/12/27 11:02:03	<input type="button" value="Answer"/>

Afficher un menu

Comparison tool (beta)

UCD/SPASE/PDS

❖ <http://typhon.obspm.fr/idis/ucd.php>



Unified Content Descriptor Lists

These lists have been compiled using the [UCD list provided by CDS](#) adding SPASE and PDS keywords.

ID	Name	Source	Definition	Possible Synonyms
1	arith	cds	Arithmetic quantities	
2	arith.diff	cds	Difference between two quantities described by the same UCD	
3	arith.factor	cds	Numerical factor	[pds]descriptor.factor
4	arith.grad	cds	Gradient	
5	arith.rate	cds	Rate (per time unit)	[pds]descriptor.rate
6	arith.ratio	cds	Ratio between two quantities described by the same UCD	[spase]Qualifier.Ratio [pds]class.ratio
7	arith.zp	cds	Zero point	
8	em	cds	Electromagnetic spectrum	
9	em.IR	cds	Infrared part of the spectrum	
10	em.IR.15-30um	cds	Infrared between 15 and 30 micron	
11	em.IR.3-4um	cds	Infrared between 3 and 4 micron	
12	em.IR.30-60um	cds	Infrared between 30 and 60 micron	
13	em.IR.4-8um	cds	Infrared between 4 and 8 micron	
14	em.IR.60-100um	cds	Infrared between 60 and 100 micron	
15	em.IR.8-15um	cds	Infrared between 8 and 15 micron	
16	em.IR.FIR	cds	Far-Infrared, 30-100 microns	
17	em.IR.H	cds	Infrared between 1.5 and 2 micron	
18	em.IR.J	cds	Infrared between 1.0 and 1.5 micron	
19	em.IR.K	cds	Infrared between 2 and 3 micron	
20	em.IR.MIR	cds	Medium-Infrared, 5-30 microns	
21	em.IR.NIR	cds	Near-Infrared, 1-5 microns	

Comparison tool (beta) UCD/SPASE/PDS

- ❖ <http://typhon.obspm.fr/idis/ucd.php>

Unified Content Descriptor Lists

These lists have been compiled using the [UCD list provided by CDS](#) adding SPASE and PDS keywords.

ID	Name	Source	Definition	Possible Synonyms
245	phys.electron	cds	Electron	[spase]Particle.ParticleType.Electron [idis]phys.particle.electron
246	phys.electron.degen	cds	Electron degeneracy parameter	
293	phys.temperature.electron	cds	Electron temperature	
653	Particle.ParticleType.Electron	spase	An elementary particle consisting of a charge of negative electricity equal to about 1.602×10^{-19} Coulomb and having a mass when at rest of about 9.109534×10^{-28} gram.	[cds]phys.electron [idis]phys.particle.electron
915	phys.particle.electron	idis	Related to electron (An elementary particle consisting of a charge of negative electricity equal to about 1.602×10^{-19} Coulomb and having a mass when at rest of about 9.109534×10^{-28} gram).	

Number of record selected: 5

POWERED BY
Mac OS X Server

UCD for Solar Physics and Heliophysics

- ❖ Main source of inputs: **HELIO (EU-FP7) project**.
- ❖ The HELIO group developed data models and metadata to describe event catalogs, physical parameters, datasets, observatories...
UCD was one of the adopted standards.
- ❖ Quantities to be described:
 - *events, times, durations, rotation or revolution number (**time.epoch...**)*
 - *physical parameters (remote sensing and in-situ; photons, waves, fields and particle;) and type of quantity*
 - *location (**pos.bodyrc,...**)*
 - *measured, modeled, processed or derived parameters (as in **phys.modeled?**)*
- ❖ *NB: for space physics, the SPASE data model is comparable to UCDs (or may be closer to a SKOS description)*

UCD for Planetary Sciences

- ❖ Main source of inputs: **Europlanet-RI/IDIS (EU-FP7) project.**
- ❖ The IDIS group developed a data model and metadata to describe datasets and granules (i.e. usually files), as well as physical parameters and axis. Several IVOA standards were used (VOResource, VOUnit, STC, Characterization, TAP, Registry, UCD...). The current implementation is EPN-TAP.
- ❖ Quantities to be described (19 mandatory parameters in EPN-TAP):
 - *temporal, spectral and spatial axes, coordinate systems*
 - *physical parameters (remote sensing and in-situ; photons, waves, fields and particle;) and type of quantity*
 - *instruments and observatories*
 - *observation conditions*

Suggestions and questions Comets and Samples (1)

- * Input from Italian EPN group (description of planetary samples)
- * Suggested set of new UCDs:
 - **phys.color** (*color of an object, generally assigned at eye, NOT USABLE for spectral type of stars NOR for the color index, e.g.: 'black', 'reddish'*)
 - **phys.luster** (*luster of an object, e.g.: 'pearly', 'metallic', 'vitreous'... mineralogical property, generally assigned at eye*)
 - **phys.porosity** (*porosity percentage of the body*)
 - **phys.shape** (*shape of an object, e.g.: 'irregular', 'spherical'...*)
 - **phys.transparency** (*transparency of a solid, e.g.: 'opaque', 'translucent', 'transparent' mineralogical property, generally assigned at eye*)
- * Hierarchical propositions:
 - **phys.aspect** ? (*«phys.aspect.color», «phys.aspect.luster»...*)
 - **phys.sample** (*relative to sample: «phys.sample.aspect.color»*) or associated to the existing UCD **src.sample** ? (*«src.sample;phys.aspect.color»...*)

Suggestions and questions Comets and Samples (2)

- ❖ Input from Italian EPN group (description of planetary samples)
- ❖ Set of new UCDs proposed for evaluation :
 - **phys.mol.elecband** (*electronic band of the transition*)
 - **phys.mol.species** (*species*)
 - **phys.reflectance** (*reflectance of the body*)
 - **phys.sample.cluster** (*Eventually indicates the cluster to which the sample belongs*)
 - **phys.size.smedAxis** (*for 3d objects a third axis is necessary*) linked to *phys.size.smajAxis* and *phys.size.sminAxis*
 - **src.group** (*group, family or dynamical class of the object, e.g.: 'Halley type comet', 'AGNII', 'Themis family asteroid'*)
 - **src.orbital.TissJ** (*Tisserand parameter respect to Jupiter*)
 - **em.line.FeKalpha** (*Fe K alpha line at 6.4 keV*)
 - **em.molecline** (*Designation of molecular lines*)
 - **em.molecline.C2** (*number of C2 lines in the observed range*)
 - **em.molecline.C3** (*number of C3 lines in the observed range*)
 - **em.molecline.CH** (*number of CH lines in the observed range*)
 - **em.molecline.NH2** (*number of NH2 lines in the observed range*)
 - **em.molecline.CN** (*number of CN lines in the observed range*)

Suggestions and questions

Comets and Samples (3)

- ❖ Input from Italian EPN group (description of planetary samples)
- ❖ Suggested UCDs for which we found possible equivalent UCDs:
 - **phys.sample.magnetized** ('yes', 'no', 'partially'...)
=> **src.sample;phys.magField;meta.flag**
 - **phys.sample.mass** (*mass of the sample*)
=> **src.sample;phys.mass**
 - **phys.sample.parentbody** (*Parent body of the sample, it can be generic or specific, very hard to recognize for dust, e.g.: 'Itokawa', 'asteroid', 'Moon'...*)
=> **src.sample;meta.id.parent**
 - **phys.sample.retrloc** (*retrieval location of the sample, e.g.: 'Moon, Mare Serenitatis', 'Earth stratosphere, above Sahara desert', 'Interplanetary medium at 2 AU'...*)
=> **src.sample;pos**
 - **phys.sample.type** ('Cosmic dust', 'Artificial terrestrial contamination', 'Lunar basalt'...)
=> **src.sample;meta.note**
 - **src.id** (*Identifier of the object, e.g.: 'alpha CMa', 'Jupiter Sol-4', '2P/Encke', 'NGC 2683'*)
=> **src.sample;meta.id**
 - **src.orbital.smajAxis**
=> **src;phys.angSize.smajAxis** ? (Note: «angSize» implies sky observation, not 3D measurement)

Suggestions and questions

Space Physics

- ❖ Input from CDPP (Toulouse, France), LESIA (Meudon, France), IWF (Graz, Austria)
- ❖ Set of new UCDs proposed for evaluation :
 - **phys.count** (*same as phot.count, but for anything else than photons*)
 - **phys.particle**
 - **phys.particle.aerosol**
 - **phys.particle.alpha**
 - **phys.particle.atom**
 - **phys.particle.dust**
 - **phys.particle.electron**
 - **phys.particle.ion**
 - **em.pw** (*local plasma waves*)
 - **phys.energy.flux** (*instead of phot.energy.flux ?*)
 - **phys.flow** (*relative to flow of particles or matter*)
 - **phys.gyrofrequency**
 - **phys.plasmafrequency**
 - **phys.heatflux**
 - **phys.phaseSpaceDensity**
 - «**em.radio below 20 MHz ?**»
- ❖ Energy bands for particle (electrons, ions or neutral) measurement ? (in eV / keV / MeV) Same for Mass spectroscopy (in atomic mass unit) ? and for «Mass per charge» ?

Suggestions and questions

Imaging and Spectroscopy

- ❖ Input from LESIA (Meudon, France)
- ❖ Set of new UCDs proposed for evaluation :
 - **em.UV.EUV** (*next to em.UV.FUV, but for anything else than photons*)
 - **em.band** (*similarly to em.line, but for molecular bands*)
 - **em.band.CH4**
 - **em.band.H2O**
 - **em.band.CO2**
 - **em.band....** (*many more possible, very long list !*)
 - **meta.id.CoPI** (*similarly to meta.id.coI and meta.id.PI*)
 - **meta.processed** (*obtained through a processing pipeline*)
 - **meta.derived** (*obtained from a combination of observation and models*)
 - **em.molecline.rotation**
 - **em.molecline.vibration**
 - **obs.calib.dark**
 - **phot.radiance**
 - **phot.reflectance**
 - **pos.occult => pos.limb;obs.occult**
 - **src.orbital.smajAxis** \neq **phys.angSize.smajAxis**
 - **src.orbital.sminAxis** \neq **phys.angSize.sminAxis**
 - **src.orbital.number** (*number of the current revolution*)
 - **time.period.number** (*number of the current rotation, e.g. day number on Earth*)

Suggestions and questions

Solar and Heliphysics

- ❖ Input from HELIO Project (Europe)
- ❖ Set of new UCDs proposed for evaluation :
 - **time.period.number** (*number of the current rotation, e.g. number of the Carrington rotation of the Sun*)
 - **instr.obsty.experiment**
 - **pos.heliographic** (*centered on the center of the sun as seen from observer*)
- ❖ Note: ongoing job, just begun.

Concluding remarks

- ❖ Ongoing work !
- ❖ More new cases will come soon as we start up new database ingestion into EPN-TAP services (Europlanet Project)
- ❖ Each suggestion will be discussed using available tools and documents. We will always check if adapted existing UCD can be used.
- ❖ Up to now, we found no need for new «main category».
- ❖ How to proceed with propose update list for UCD ?