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UCD1+ controlled vocabulary

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The UCD1+ controlled vocabulary 1.3
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Abstract

This document describes the list of controlled terms used to build the Unified Content Descriptors, Version 1+ (UCD1+). The document describing the UCD1+ can be found at the URL: `http://www.ivoa.net/Documents/latest/UCD.html`. This document reviews the structure of the UCD1+ and presents the current vocabulary.

This version contains new UCD words discussed and accepted by the Semantics Working Group during the UCD list v1.3 RFM.

Status of this document

This is an IVOA Proposed Endorsed Note for review by IVOA members and other interested parties. It is appropriate to reference this document only as a Proposed Endorsed Note that is under review and may change before it is endorsed or may not be endorsed.

A list of current IVOA Recommendations and other technical documents can be found at http://www.ivoa.net/documents/.

Contents

1 Definition of atoms and words

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:

$$\text{atoms} \rightarrow \text{words} \rightarrow \text{composed words}$$

UCD1+ are either single words, or a composition of several words.

UCDs are "controlled" through a process defined in the IVOA. See Derriere and Gray et al. (2004) and section 1.2 below. Control is exercised at the level of words (UCD1+) and at the level of the vocabulary (atoms) used to form words. A consistent list of atoms will be maintained, making sure that the same atom always means the same thing, even if used in combination with different other atoms.

1.1 Definition of atoms

Atoms are defined following these guidelines:

1. Abbreviations are used in contexts where their meaning is unambiguous. (**ra**, **dec** are acceptable, but **t** is ambiguous: **time** and **temperature** are used instead.)

2. Atoms are not hyphenated. The separation is marked by a capital letter to help readability (position angle = **posAng**) unless the composed word has a well- known acronym (signal to noise ratio = **snr**) or short form (standard deviation = **stdev**). There are only two exceptions to this rule: (i) the X-ray band (**em.X-ray**) and (ii) the frequency / wavelength intervals defining regions of the e.m. spectrum (e.g., **em.radio.3-6GHz**).

1.2 Definition of words

The list of UCD1+ words presented in this document was initially generated applying the rules and recommendations of PR-UCD-20040823 to catalogues/tables in VizieR. The original motivation was to transform old UCD1 into an improved version, trying to build a list of combinations of new words that could describe all the existing UCD1 terms.

The list of UCD1+ words is maintained by the UCD Scientific Board, following the procedure defined in the UCD Recommendation document (Derriere and Gray et al., 2004) and described in detail in Genova and Louys et al. (2019)[1].

2 The structure of the UCD1+ tree

All existing UCD1+ words are grouped into 12 main categories. These categories are expressed by the first atom of the word, whose possible values are:

1. **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.

2. **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 electromagnetic spectrum: radio, millimetre, infrared, optical, ultraviolet, x-ray and gamma- ray), can be found in the document https://wiki.ivoa.net/internal/IVOA/IvoaUCD/NoteEMSpectrum-20040520.html

3. **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.

4. **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.

[1] An earlier draft on UCD building, still at http://www.ivoa.net/documents/PR/UCD/UCD-20040823.html includes more details about the process of the change from the earlier "UCD1" standard, and may be of historical interest, or provide more rationale.

5. **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, this section helps to identify concepts related to an observation process.

6. **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 electromagnetic spectrum 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.

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

8. **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 World Coordinate System FITS keywords.

9. **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 measures like a flux under the **phot** branch, and spectral measures spectral line physical features one can measure on a spectrum, for instance, under the **spect** branch.

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

11. **stat** (statistics)
    This section includes statistical information on measurements.

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

3 Combining UCD words

3.1 Goal

Since their definition UCDs have been used in major catalogue archives, in the definition of various VO protocols (SSA, SIAv2, SLAP, TAP ObsTAP, EPN-TAP, etc.) and used with success to provide semantic annotation for a huge collection of table columns distributed in the astronomical community.

The list of terms has increased and the usage of UCD combination has become very common. This leads to a richer set of rules in the assigning and checking tools developed at CDS with VO partners.

In order to keep the consistency in the UCD thesaurus, each rule is adjusted and weighted considering the physical usage of the quantities represented in table columns, so the pertinence increases with the context. Initially used for source catalogues (Vizier, Heasarc archives, etc.) in the first place, they are now also used in VOTable documents for planetary data (Erard and Cecconi et al., 2019, 2018) and all sorts of metadata.

3.2 Remarks on combination rules

The combination rules have been defined in the first IVOA documents defining UCD concept (Derriere and Gray et al., 2004). They are exposed with a syntax tag given as a property of each UCD word and included in the list of UCD words. See Appendix B with the tags definitions on top.

They correspond to real usage of the terms in science publications and are attached to the description of catalogues' column by experimented data scientists. UCD combination also reflects the catalogues build-up strategy. Errors and statistics, for instance, are provided with measurement values; measures and model comparison are evaluated with error fits, precision, etc. All the scientific knowledge helps to define appropriate UCD words combination.

The assigning tool proposed at `http://cds.u-strasbg.fr/UCD/cgi-bin/descr2ucd` is based on the pragmatic encoding of physical quantities found in science papers and data attached to publications.

A Current questions about combinations of UCDs

A.1 How do UCDs differ from structured descriptions?

UCDs do not provide a structured representation of table content but the meaning or relative class concept known at the time for the astronomical speciality. Therefore, the structure of words and their rules for combination do not follow any object oriented paradigm, in contradiction to any reference to a data model item (Utype, VO-DML type /role definition), which are dependent of a defined and endorsed IVOA data model specification.

A.2 P or S syntax code: Which is the most pertinent position for a UCD word?

P, S and Q are the labels expressing in which position of a UCD expression a term can be used, P in first place, S as suffix, and Q in both allowed position: head and tail. The UCD list defines the recommended position for each word with some flexibility.

P is always what matters the most to describe a quantity, i.e., the kind of property that should be searched for in primary order, and the most relevant UCD words to represent a quantity.

S is the code for the qualifying part of the UCD, the secondary information appended to specify the first UCD term.

Examples:

- Give me all columns / all catalogues with a column having a magnitude in R: `magnitude` is the primary concept and band R is the secondary concept, so the ucd to search for is `phot.mag;em.opt.R`.

- Give me all columns with an error on magnitude B: here we shall use a query with ucd equals to `stat.error;phot.mag;em.opt.B`. Here the main concept attached to the column value is error, qualified by `phot.mag`, itself qualified by `em.opt.B`.

Concatenation can apply more than one time, depending on ordering rules. See Derriere and Gray et al. (2004), section 3.3, for other details.

B List of valid words

All words are preceded by a 'syntax' code that can help in the process of building composed UCD1+.

1. "P" means that the word can only be used as "primary" or first word;
2. "S" stands for only secondary: the word cannot be used as the first word to describe a single quantity;
3. "Q" means that the word can be used indifferently as first or secondary word;

   The following cases behave as Q prefix and can be combined as primary or secondary. They specialize the combination rules:

   3.1. "E" means a photometric quantity, and can be followed by a word describing a part of the electromagnetic spectrum;

   3.2. "C" is a colour index, and can be followed by two successive word describing a part of the electromagnetic spectrum;

   3.3. "V" stands for vector. Such a word can be followed by another describing the axis or reference frame in which the measurement is done.

UCD word		Description
Q	arith	Arithmetic quantities
S	arith.diff	Difference between two quantities described by the same UCD
P	arith.factor	Numerical factor
P	arith.grad	Gradient
P	arith.rate	Rate (per time unit)
S	arith.ratio	Ratio between two quantities described by the same UCD
S	arith.squared	Squared quantity
S	arith.sum	Summed or integrated quantity
S	arith.variation	Generic variation of a quantity
Q	arith.zp	Zero point
S	em	Electromagnetic spectrum
S	em.IR	Infrared part of the spectrum
S	em.IR.J	Infrared between 1.0 and 1.5 micron
S	em.IR.H	Infrared between 1.5 and 2 micron
S	em.IR.K	Infrared between 2 and 3 micron
S	em.IR.3-4um	Infrared between 3 and 4 micron
S	em.IR.4-8um	Infrared between 4 and 8 micron
S	em.IR.8-15um	Infrared between 8 and 15 micron
S	em.IR.15-30um	Infrared between 15 and 30 micron
S	em.IR.30-60um	Infrared between 30 and 60 micron
S	em.IR.60-100um	Infrared between 60 and 100 micron
S	em.IR.NIR	Near-Infrared, 1-5 microns
S	em.IR.MIR	Medium-Infrared, 5-30 microns
S	em.IR.FIR	Far-Infrared, 30-100 microns
S	em.UV	Ultraviolet part of the spectrum
S	em.UV.10-50nm	Ultraviolet between 10 and 50 nm EUV extreme UV
S	em.UV.50-100nm	Ultraviolet between 50 and 100 nm
S	em.UV.100-200nm	Ultraviolet between 100 and 200 nm FUV Far UV
S	em.UV.200-300nm	Ultraviolet between 200 and 300 nm NUV near UV
S	em.X-ray	X-ray part of the spectrum
S	em.X-ray.soft	Soft X-ray (0.12 - 2 keV)
S	em.X-ray.medium	Medium X-ray (2 - 12 keV)
S	em.X-ray.hard	Hard X-ray (12 - 120 keV)
Q	em.bin	Channel / instrumental spectral bin coordinate (bin number)
Q	em.energy	Energy value in the em frame
Q	em.freq	Frequency value in the em frame
Q	em.freq.cutoff	cutoff frequency
Q	em.freq.resonance	resonance frequency
S	em.gamma	Gamma rays part of the spectrum
S	em.gamma.soft	Soft gamma ray (120 - 500 keV)
S	em.gamma.hard	Hard gamma ray (>500 keV)
S	em.line	Designation of major atomic lines
S	em.line.HI	21cm hydrogen line
S	em.line.Lyalpha	H-Lyalpha line
S	em.line.Halpha	H-alpha line
S	em.line.Hbeta	H-beta line
S	em.line.Hgamma	H-gamma line
S	em.line.Hdelta	H-delta line
S	em.line.Brgamma	Bracket gamma line
S	em.line.OIII	[OIII] line whose rest wl is 500.7 nm
S	em.line.CO	CO radio line, e.g 12CO(1-0) at 115GHz
S	em.mm	Millimetric/submillimetric part of the spectrum
S	em.mm.30-50GHz	Millimetric between 30 and 50 GHz
S	em.mm.50-100GHz	Millimetric between 50 and 100 GHz
S	em.mm.100-200GHz	Millimetric between 100 and 200 GHz
S	em.mm.200-400GHz	Millimetric between 200 and 400 GHz
S	em.mm.400-750GHz	Millimetric between 400 and 750 GHz
S	em.mm.750-1500GHz	Millimetric between 750 and 1500 GHz
S	em.mm.1500-3000GHz	Millimetric between 1500 and 3000 GHz

S	em.opt	Optical part of the spectrum
S	em.opt.U	Optical band between 300 and 400 nm
S	em.opt.B	Optical band between 400 and 500 nm
S	em.opt.V	Optical band between 500 and 600 nm
S	em.opt.R	Optical band between 600 and 750 nm
S	em.opt.I	Optical band between 750 and 1000 nm
S	em.pw	Plasma waves (trapped in local medium)
S	em.radio	Radio part of the spectrum
S	em.radio.20MHz	Radio below 20 MHz
S	em.radio.20-100MHz	Radio between 20 and 100 MHz
S	em.radio.100-200MHz	Radio between 100 and 200 MHz
S	em.radio.200-400MHz	Radio between 200 and 400 MHz
S	em.radio.400-750MHz	Radio between 400 and 750 MHz
S	em.radio.750-1500MHz	Radio between 750 and 1500 MHz
S	em.radio.1500-3000MHz	Radio between 1500 and 3000 MHz
S	em.radio.3-6GHz	Radio between 3 and 6 GHz
S	em.radio.6-12GHz	Radio between 6 and 12 GHz
S	em.radio.12-30GHz	Radio between 12 and 30 GHz
Q	em.wavenumber	Wavenumber value in the em frame
Q	em.wl	Wavelength value in the em frame
Q	em.wl.central	Central wavelength
Q	em.wl.effective	Effective wavelength
Q	instr	Instrument
E	instr.background	Instrumental background
Q	instr.bandpass	Bandpass (e.g.: band name) of instrument
Q	instr.bandwidth	Bandwidth of the instrument
Q	instr.baseline	Baseline for interferometry
S	instr.beam	Beam
Q	instr.calib	Calibration parameter
S	instr.det	Detector
Q	instr.det.noise	Instrument noise
Q	instr.det.psf	Point Spread Function
Q	instr.det.qe	Quantum efficiency
Q	instr.dispersion	Dispersion of a spectrograph
Q	instr.experiment	Experiment or group of instruments
S	instr.filter	Filter
S	instr.fov	Field of view
S	instr.obsty	Observatory, satellite, mission
Q	instr.obsty.seeing	Seeing
Q	instr.offset	Offset angle respect to main direction of observation
Q	instr.order	Spectral order in a spectrograph
Q	instr.param	Various instrumental parameters
S	instr.pixel	Pixel (default size: angular)
S	instr.plate	Photographic plate
Q	instr.plate.emulsion	Plate emulsion
Q	instr.precision	Instrument precision
Q	instr.rmsf	Rotation Measure Spread Function
Q	instr.saturation	Instrument saturation threshold
Q	instr.scale	Instrument scale (for CCD, plate, image)
Q	instr.sensitivity	Instrument sensitivity, detection threshold
Q	instr.setup	Instrument configuration or setup
Q	instr.skyLevel	Sky level
Q	instr.skyTemp	Sky temperature
Q	instr.tel	Telescope
Q	instr.tel.focalLength	Telescope focal length
S	instr.voxel	Related to a voxel (n-D volume element with n>2)
P	meta	Metadata
P	meta.abstract	Abstract (of paper, proposal, etc.)
P	meta.bib	Bibliographic reference
P	meta.bib.author	Author name
P	meta.bib.bibcode	Bibcode
P	meta.bib.fig	Figure in a paper

P	meta.bib.journal	Journal name
P	meta.bib.page	Page number
P	meta.bib.volume	Volume number
Q	meta.calibLevel	Processing/calibration level
Q	meta.checksum	Numerical signature of digital data
P	meta.code	Code or flag
P	meta.code.class	Classification code
P	meta.code.error	Limit uncertainty error flag
P	meta.code.member	Membership code
P	meta.code.mime	MIME type
P	meta.code.multip	Multiplicity or binarity flag
P	meta.code.qual	Quality, precision, reliability flag or code
P	meta.code.status	Status code (e.g.: status of a proposal/observation)
P	meta.cryptic	Unknown or impossible to understand quantity
P	meta.curation	Identity of man/organization responsible for the data
Q	meta.dataset	Dataset
Q	meta.email	Curation/contact e-mail
S	meta.file	File
S	meta.fits	FITS standard
P	meta.id	Identifier, name or designation
P	meta.id.assoc	Identifier of associated counterpart
P	meta.id.CoI	Name of Co-Investigator
P	meta.id.cross	Cross identification
P	meta.id.parent	Identification of parent source
P	meta.id.part	Part of identifier, suffix or sub-component
P	meta.id.PI	Name of Principal Investigator or Co-PI
S	meta.main	Main value of something
S	meta.modelled	Quantity was produced by a model
P	meta.note	Note or remark (longer than a code or flag)
P	meta.number	Number (of things; e.g. nb of object in an image)
S	meta.preview	Related to a preview operation for a dataset
Q	meta.query	A query posed to an information system or database or a property of it
P	meta.record	Record number
P	meta.ref	Reference or origin
P	meta.ref.doi	DOI identifier (dereferenceable)
Q	meta.ref.ivoid	Identifier as recommended in the IVOA (dereferenceable)
P	meta.ref.ivorn	Identifier defined as IVORN, VO Resource Name (ivo://) (deprecated)
P	meta.ref.uri	URI, universal resource identifier
P	meta.ref.url	URL, web address
S	meta.software	Software used in generating data
S	meta.table	Table or catalogue
P	meta.title	Title or explanation
Q	meta.ucd	UCD
P	meta.unit	Unit
P	meta.version	Version
S	obs	Observation
Q	obs.airMass	Airmass
S	obs.atmos	Atmosphere, atmospheric phenomena affecting an observation
Q	obs.atmos.extinction	Atmospheric extinction
Q	obs.atmos.refractAngle	Atmospheric refraction angle
S	obs.calib	Calibration observation
S	obs.calib.flat	Related to flat-field calibration observation (dome, sky, ..)
S	obs.calib.dark	Related to dark current calibration
S	obs.exposure	Exposure
S	obs.field	Region covered by the observation
S	obs.image	Image
Q	obs.observer	Observer, discoverer
S	obs.occult	Observation of occultation phenomenon by solar system objects
S	obs.transit	Observation of transit phenomenon : exo-planets
Q	obs.param	Various observation or reduction parameter
S	obs.proposal	Observation proposal
Q	obs.proposal.cycle	Proposal cycle

S	obs.sequence	Sequence of observations, exposures or events
E	phot	Photometry
E	phot.antennaTemp	Antenna temperature
Q	phot.calib	Photometric calibration
C	phot.color	Color index or magnitude difference
Q	phot.color.excess	Color excess
Q	phot.color.reddFree	Dereddened color
E	phot.count	Flux expressed in counts
E	phot.fluence	Radiant photon energy received by a surface per unit area or irradiance of a surface integrated over time of irradiation
E	phot.flux	Photon flux or irradiance
Q	phot.flux.bol	Bolometric flux
E	phot.flux.density	Flux density (per wl/freq/energy interval)
E	phot.flux.density.sb	Flux density surface brightness
E	phot.flux.sb	Flux surface brightness
E	phot.limbDark	Limb-darkening coefficients
E	phot.mag	Photometric magnitude
E	phot.mag.bc	Bolometric correction
Q	phot.mag.bol	Bolometric magnitude
Q	phot.mag.distMod	Distance modulus
E	phot.mag.reddFree	Dereddened magnitude
E	phot.mag.sb	Surface brightness in magnitude units
E	phot.radiance	Radiance as energy flux per solid angle
Q	phys	Physical quantities
Q	phys.SFR	Star formation rate
E	phys.absorption	Extinction or absorption along the line of sight
Q	phys.absorption.coeff	Absorption coefficient (e.g. in a spectral line)
Q	phys.absorption.gal	Galactic extinction
Q	phys.absorption ...opticalDepth	Optical depth
Q	phys.abund	Abundance
Q	phys.abund.Fe	Fe/H abundance
Q	phys.abund.X	Hydrogen abundance
Q	phys.abund.Y	Helium abundance
Q	phys.abund.Z	Metallicity abundance
Q	phys.acceleration	Acceleration
S	phys.aerosol	Relative to aerosol
Q	phys.albedo	Albedo or reflectance
Q	phys.angArea	Angular area
Q	phys.angMomentum	Angular momentum
E	phys.angSize	Angular size width diameter dimension extension major minor axis extraction radius
E	phys.angSize.smajAxis	Angular size extent or extension of semi-major axis
E	phys.angSize.sminAxis	Angular size extent or extension of semi-minor axis
Q	phys.area	Area (in surface, not angular units)
S	phys.atmol	Atomic and molecular physics (shared properties)
Q	phys.atmol ...branchingRatio	Branching ratio
S	phys.atmol.collisional	Related to collisions
Q	phys.atmol.collStrength	Collisional strength
Q	phys.atmol.configuration	Configuration
Q	phys.atmol.crossSection	Atomic / molecular cross-section
Q	phys.atmol.element	Element
Q	phys.atmol.excitation	Atomic molecular excitation parameter
Q	phys.atmol.final	Quantity refers to atomic/molecular final/ground state, level, etc.
Q	phys.atmol.initial	Quantity refers to atomic/molecular initial state, level, etc.
Q	phys.atmol.ionStage	Ion, ionization stage
S	phys.atmol.ionization	Related to ionization
Q	phys.atmol.lande	Lande factor
S	phys.atmol.level	Atomic level
Q	phys.atmol.lifetime	Lifetime of a level
Q	phys.atmol.lineShift	Line shifting coefficient

Q	phys.atmol.number	Atomic number Z
Q	phys.atmol.oscStrength	Oscillator strength
Q	phys.atmol.parity	Parity
Q	phys.atmol.qn	Quantum number
Q	phys.atmol.radiationType	Type of radiation characterizing atomic lines (electric dipole/quadrupole, magnetic dipole)
Q	phys.atmol.symmetry	Type of nuclear spin symmetry
Q	phys.atmol.sWeight	Statistical weight
Q	phys.atmol.sWeight ...nuclear	Statistical weight for nuclear spin states
Q	phys.atmol.term	Atomic term
S	phys.atmol.transition	Transition between states
Q	phys.atmol.transProb	Transition probability, Einstein A coefficient
Q	phys.atmol.wOscStrength	Weighted oscillator strength
Q	phys.atmol.weight	Atomic weight
Q	phys.columnDensity	Column density
S	phys.composition	Quantities related to composition of objects
Q	phys.composition ...massLightRatio	Mass to light ratio
Q	phys.composition.yield	Mass yield
S	phys.cosmology	Related to cosmology
Q	phys.current	Electric current
Q	phys.current.density	Electric current density
Q	phys.damping	Generic damping quantities
Q	phys.density	Density (of mass, electron, ...)
Q	phys.density.phaseSpace	Density in the phase space
Q	phys.dielectric	Complex dielectric function
Q	phys.dispMeasure	Dispersion measure
S	phys.dust	Relative to dust
Q	phys.electCharge	Electric charge
V	phys.electField	Electric field
S	phys.electron	Electron
Q	phys.electron.degen	Electron degeneracy parameter
Q	phys.emissMeasure	Emission measure
Q	phys.emissivity	Emissivity
Q	phys.energy	Energy
Q	phys.energy.Gibbs	Gibbs (free) energy or free enthalpy [G=H –TS]
Q	phys.energy.Helmholtz	Helmholtz free energy [A=U–TS]
Q	phys.energy.density	Energy density
Q	phys.enthalpy	Enthalpy [H=U+pv]
Q	phys.entropy	Entropy
Q	phys.eos	Equation of state
Q	phys.excitParam	Excitation parameter U
E	phys.fluence	Particle energy received by a surface per unit area and integrated over time
Q	phys.flux	Flux or flow of particle, energy, etc.
Q	phys.flux.energy	Energy flux, heat flux
Q	phys.gauntFactor	Gaunt factor/correction
Q	phys.gravity	Gravity
Q	phys.ionizParam	Ionization parameter
Q	phys.ionizParam.coll	Collisional ionization
Q	phys.ionizParam.rad	Radiative ionization
E	phys.luminosity	Luminosity
Q	phys.luminosity.fun	Luminosity function
E	phys.magAbs	Absolute magnitude
Q	phys.magAbs.bol	Bolometric absolute magnitude
V	phys.magField	Magnetic field
Q	phys.mass	Mass
Q	phys.mass ...inertiaMomentum	Momentum of inertia or rotational inertia
Q	phys.mass.loss	Mass loss
Q	phys.mol	Molecular data
Q	phys.mol.dipole	Molecular dipole

Q	phys.mol.dipole.electric	Molecular electric dipole moment
Q	phys.mol.dipole.magnetic	Molecular magnetic dipole moment
Q	phys.mol.dissociation	Molecular dissociation
Q	phys.mol.formationHeat	Formation heat for molecules
Q	phys.mol.quadrupole	Molecular quadrupole
Q	phys.mol.quadrupole ...electric	Molecular electric quadrupole moment
S	phys.mol.rotation	Molecular rotation
S	phys.mol.vibration	Molecular vibration
S	phys.particle	Related to physical particles
S	phys.particle.neutrino	Related to neutrino
S	phys.particle.neutron	Related to neutron
S	phys.particle.proton	Related to proton
S	phys.particle.alpha	Related to alpha particle
S	phys.phaseSpace	Related to phase space
E	phys.polarization	Polarization degree (or percentage)
Q	phys.polarization ...circular	Circular polarization
Q	phys.polarization ...coherency	Matrix of the correlation between components of an electromagnetic wave
Q	phys.polarization.linear	Linear polarization
Q	phys.polarization ...rotMeasure	Rotation measure polarization
Q	phys.polarization.stokes	Stokes polarization
Q	phys.polarization.stokes ...I	Stokes polarization coefficient I
Q	phys.polarization.stokes ...Q	Stokes polarization coefficient Q
Q	phys.polarization.stokes ...U	Stokes polarization coefficient U
Q	phys.polarization.stokes ...V	Stokes polarization coefficient V
Q	phys.potential	Potential (electric, gravitational, etc.)
Q	phys.pressure	Pressure
Q	phys.recombination.coeff	Recombination coefficient
Q	phys.reflectance	Radiance factor (received radiance divided by input radiance)
Q	phys.reflectance ...bidirectional	Bidirectional reflectance
Q	phys.reflectance ...bidirectional.df	Bidirectional reflectance distribution function
Q	phys.reflectance.factor	Reflectance normalized per direction cosine of incidence angle
Q	phys.refractIndex	Refraction index
Q	phys.size	Linear size, length (not angular)
Q	phys.size.axisRatio	Axis ratio (a/b) or (b/a)
Q	phys.size.diameter	Diameter
Q	phys.size.radius	Radius
Q	phys.size.smajAxis	Linear semi major axis
Q	phys.size.sminAxis	Linear semi minor axis
Q	phys.size.smedAxis	Linear semi median axis for 3D ellipsoids
Q	phys.temperature	Temperature
Q	phys.temperature ...effective	Effective temperature
Q	phys.temperature ...electron	Electron temperature
Q	phys.transmission	Transmission (of filter, instrument, ...)
V	phys.veloc	Space velocity
Q	phys.veloc.ang	Angular velocity
Q	phys.veloc.dispersion	Velocity dispersion
Q	phys.veloc.escape	Escape velocity
Q	phys.veloc.expansion	Expansion velocity
Q	phys.veloc.microTurb	Microturbulence velocity
Q	phys.veloc.orbital	Orbital velocity

Q	phys.veloc.pulsat	Pulsational velocity
Q	phys.veloc.rotat	Rotational velocity
Q	phys.veloc.transverse	Transverse / tangential velocity
S	phys.virial	Related to virial quantities (mass, radius, ..)
Q	phys.volume	Volume (in cubic units)
Q	pos	Position and coordinates
Q	pos.angDistance	Angular distance, elongation
Q	pos.angResolution	Angular resolution
Q	pos.az	Position in alt-azimutal frame
Q	pos.az.alt	Alt-azimutal altitude
Q	pos.az.azi	Alt-azimutal azimut
Q	pos.az.zd	Alt-azimutal zenith distance
Q	pos.azimuth	Azimuthal angle in a generic reference plane
S	pos.barycenter	Barycenter
S	pos.bodycentric	Body-centric related coordinate
S	pos.bodygraphic	Body-graphic related coordinate
S	pos.bodyrc	Body related coordinates
Q	pos.bodyrc.alt	Body related coordinate (altitude on the body)
Q	pos.bodyrc.lat	Body related coordinate (latitude on the body)
Q	pos.bodyrc.lon	Body related coordinate (longitude on the body)
S	pos.cartesian	Cartesian (rectangular) coordinates
Q	pos.cartesian.x	Cartesian coordinate along the x-axis
Q	pos.cartesian.y	Cartesian coordinate along the y-axis
Q	pos.cartesian.z	Cartesian coordinate along the z-axis
S	pos.centroid	Related to centroid position
S	pos.cmb	Cosmic Microwave Background reference frame
S	pos.cylindrical	Related to cylindrical coordinates
Q	pos.cylindrical.azi	Azimuthal angle around z-axis (cylindrical coordinates)
Q	pos.cylindrical.r	Radial distance from z-axis (cylindrical coordinates)
Q	pos.cylindrical.z	Height or altitude from reference plane (cylindrical coordinates)
Q	pos.dirCos	Direction cosine
V	pos.distance	Linear distance
S	pos.earth	Coordinates related to Earth
Q	pos.earth.altitude	Altitude, height on Earth above sea level
Q	pos.earth.lat	Latitude on Earth
Q	pos.earth.lon	Longitude on Earth
S	pos.ecliptic	Ecliptic coordinates
Q	pos.ecliptic.lat	Ecliptic latitude
Q	pos.ecliptic.lon	Ecliptic longitude
Q	pos.emergenceAng	Emergence angle of optical ray on an interface
S	pos.eop	Earth orientation parameters
Q	pos.ephem	Ephemeris
Q	pos.eq	Equatorial coordinates
Q	pos.eq.dec	Declination in equatorial coordinates
Q	pos.eq.ha	Hour-angle
Q	pos.eq.ra	Right ascension in equatorial coordinates
Q	pos.eq.spd	South polar distance in equatorial coordinates
S	pos.errorEllipse	Positional error ellipse
Q	pos.frame	Reference frame used for positions
S	pos.galactic	Galactic coordinates
Q	pos.galactic.lat	Latitude in galactic coordinates
Q	pos.galactic.lon	Longitude in galactic coordinates
S	pos.galactocentric	Galactocentric coordinate system
S	pos.geocentric	Geocentric coordinate system
Q	pos.healpix	Hierarchical Equal Area IsoLatitude Pixelization
S	pos.heliocentric	Heliocentric position coordinate (solar system bodies)
Q	pos.HTM	Hierarchical Triangular Mesh
Q	pos.incidenceAng	Incidence angle of optical ray on an interface
S	pos.lambert	Lambert projection
S	pos.lg	Local Group reference frame
S	pos.lsr	Local Standard of Rest reference frame
Q	pos.lunar	Lunar coordinates

Q	pos.lunar.occult	Occultation by lunar limb
Q	pos.nutation	Nutation (of a body)
Q	pos.outline	Set of points outlining a region (contour)
Q	pos.parallax	Parallax
Q	pos.parallax.dyn	Dynamical parallax
Q	pos.parallax.phot	Photometric parallaxes
Q	pos.parallax.spect	Spectroscopic parallax
Q	pos.parallax.trig	Trigonometric parallax
Q	pos.phaseAng	Phase angle, e.g. elongation of earth from sun as seen from a third cel. object
V	pos.pm	Proper motion
Q	pos.posAng	Position angle of a given vector
V	pos.precess	Precession (in equatorial coordinates)
Q	pos.resolution	Spatial linear resolution (not angular)
S	pos.spherical	Related to spherical coordinates
Q	pos.spherical.azi	Azimuthal angle (spherical coordinates)
Q	pos.spherical.colat	Polar or Colatitude angle (spherical coordinates)
Q	pos.spherical.r	Radial distance or radius (spherical coordinates)
S	pos.supergalactic	Supergalactic coordinates
Q	pos.supergalactic.lat	Latitude in supergalactic coordinates
Q	pos.supergalactic.lon	Longitude in supergalactic coordinates
P	pos.wcs	WCS keywords
P	pos.wcs.cdmatrix	WCS CDMATRIX
P	pos.wcs.crpix	WCS CRPIX
P	pos.wcs.crval	WCS CRVAL
P	pos.wcs.ctype	WCS CTYPE
P	pos.wcs.naxes	WCS NAXES
P	pos.wcs.naxis	WCS NAXIS
P	pos.wcs.scale	WCS scale or scale of an image
Q	spect	Spectroscopy
Q	spect.binSize	Spectral bin size
S	spect.continuum	Continuum spectrum
Q	spect.dopplerParam	Doppler parameter b
E	spect.dopplerVeloc	Radial velocity, derived from the shift of some spectral feature
E	spect.dopplerVeloc.opt	Radial velocity derived from a wavelength shift using the optical convention
E	spect.dopplerVeloc.radio	Radial velocity derived from a frequency shift using the radio convention
E	spect.index	Spectral index
S	spect.line	Spectral line
E	spect.line.asymmetry	Line asymmetry
E	spect.line.broad	Spectral line broadening
Q	spect.line.broad.Stark	Stark line broadening coefficient
E	spect.line.broad.Zeeman	Zeeman broadening
E	spect.line.eqWidth	Line equivalent width
E	spect.line.intensity	Line intensity
E	spect.line.profile	Line profile
Q	spect.line.strength	Spectral line strength S
E	spect.line.width	Spectral line full width half maximum
Q	spect.resolution	Spectral (or velocity) resolution
S	src	Observed source viewed on the sky
S	src.calib	Calibration source
S	src.calib.guideStar	Guide star
Q	src.class	Source classification (star, galaxy, cluster, comet, asteroid)
Q	src.class.color	Color classification
Q	src.class.distance	Distance class e.g. Abell
Q	src.class.luminosity	Luminosity class
Q	src.class.richness	Richness class e.g. Abell
Q	src.class.starGalaxy	Star/galaxy discriminator, stellarity index
Q	src.class.struct	Structure classification e.g. Bautz-Morgan
Q	src.density	Density of sources
Q	src.ellipticity	Source ellipticity
Q	src.impactParam	Impact parameter
Q	src.morph	Morphology structure
Q	src.morph.param	Morphological parameter

Q	src.morph.scLength	Scale length for a galactic component (disc or bulge)
Q	src.morph.type	Hubble morphological type (galaxies)
S	src.net	Qualifier indicating that a quantity (e.g. flux) is background subtracted rather than total
Q	src.orbital	Orbital parameters
Q	src.orbital.eccentricity	Orbit eccentricity
Q	src.orbital.inclination	Orbit inclination
Q	src.orbital.meanAnomaly	Orbit mean anomaly
Q	src.orbital.meanMotion	Mean motion
Q	src.orbital.node	Ascending node
Q	src.orbital.periastron	Periastron
Q	src.orbital.Tisserand	Tisserand parameter (generic)
Q	src.orbital.TissJ	Tisserand parameter with respect to Jupiter
Q	src.redshift	Redshift
Q	src.redshift.phot	Photometric redshift
Q	src.sample	Sample
Q	src.spType	Spectral type MK
Q	src.var	Variability of source
E	src.var.amplitude	Amplitude of variation
Q	src.var.index	Variability index
Q	src.var.pulse	Pulse
Q	stat	Statistical parameters
Q	stat.asymmetry	Measure of asymmetry
P	stat.correlation	Correlation between two parameters
P	stat.covariance	Covariance between two parameters
P	stat.error	Statistical error
P	stat.error.sys	Systematic error
Q	stat.filling	Filling factor (volume, time, ..)
Q	stat.fit	Fit
P	stat.fit.chi2	Chi2
P	stat.fit.dof	Degrees of freedom
P	stat.fit.goodness	Goodness or significance of fit
S	stat.fit.omc	Observed minus computed
Q	stat.fit.param	Parameter of fit
P	stat.fit.residual	Residual fit
Q	stat.Fourier	Fourier coefficient
Q	stat.Fourier.amplitude	Amplitude of Fourier coefficient
S	stat.fwhm	Full width at half maximum
S	stat.interval	Generic interval between two limits (defined as a pair of values)
P	stat.likelihood	Likelihood
S	stat.max	Maximum or upper limit
S	stat.mean	Mean, average value
S	stat.median	Median value
S	stat.min	Minimum or lowest limit
Q	stat.param	Parameter
Q	stat.probability	Probability
P	stat.rank	Rank or order in list of sorted values
P	stat.rms	Root mean square as square root of sum of squared values or quadratic mean
P	stat.snr	Signal to noise ratio
P	stat.stdev	Standard deviation as the square root of the variance
S	stat.uncalib	Qualifier of a generic uncalibrated quantity
Q	stat.value	Miscellaneous value
P	stat.variance	Variance
P	stat.weight	Statistical weight
Q	time	Time, generic quantity in units of time or date
Q	time.age	Age
Q	time.creation	Creation time/date (of dataset, file, catalogue,...)
Q	time.crossing	Crossing time
Q	time.duration	Interval of time describing the duration of a generic event or phenomenon
Q	time.end	End time/date of a generic event
Q	time.epoch	Instant of time related to a generic event (epoch, date, Julian date, time stamp/tag,...)

Q	time.equinox	Equinox
Q	time.interval	Time interval, time-bin, time elapsed between two events, not the duration of an event
Q	time.lifetime	Lifetime
Q	time.period	Period, interval of time between the recurrence of phases in a periodic phenomenon
Q	time.period.revolution	Period of revolution of a body around a primary one (similar to year)
Q	time.period.rotation	Period of rotation of a body around its axis (similar to day)
Q	time.phase	Phase, position within a period
Q	time.processing	A time/date associated with the processing of data
Q	time.publiYear	Publication year
Q	time.relax	Relaxation time
Q	time.release	The time/date data is available to the public
Q	time.resolution	Time resolution
Q	time.scale	Timescale
Q	time.start	Start time/date of generic event

C Changes from previous versions

C.1 Changes from REC v1.3 following RFM

The modifications decided during the UCD1+ list v1.3 RFM[2] process are presented below.

Additions

Q	phys.electCharge	Electric charge
Q	phys.current	Electric current
Q	phys.current.density	Electric current density
Q	pos.incidenceAng	Incidence angle of optical ray on an interface
Q	pos.emergenceAng	Emergence angle of optical ray on an interface
Q	pos.azimuth	azimuthal angle in a generic reference plane
Q	phys.reflectance	Radiance factor (received radiance divided by input radiance)
Q	phys.reflectance.bidirectional	Bidirectional reflectance
Q	phys.reflectance.bidirectional.df	Bidirectional reflectance distribution function
Q	phys.reflectance.factor	Reflectance normalized per direction cosine of incidence angle
S	pos.cylindrical	Related to cylindrical coordinates
Q	pos.cylindrical.r	Radial distance from z-axis (cylindrical coordinates)
Q	pos.cylindrical.azi	Azimuthal angle around z-axis (cylindrical coordinates)
Q	pos.cylindrical.z	Height or altitude from reference plane (cylindrical coordinates)
S	pos.spherical	Related to spherical coordinates
Q	pos.spherical.r	Radial distance or radius (spherical coordinates)
Q	pos.spherical.colat	Polar or Colatitude angle (spherical coordinates)
Q	pos.spherical.azi	Azimuthal angle (spherical coordinates)
Q	pos.resolution	Spatial linear resolution (not angular)
S	pos.bodycentric	Body-centric related coordinate
S	pos.bodygraphic	Body-graphic related coordinate
Q	meta.checksum	Numerical signature of digital data
Q	phys.polarization.coherency	Matrix of the correlation between components of an electromagnetic wave

[2] https://wiki.ivoa.net/twiki/bin/view/IVOA/UCDList_1-3_RFM

Clarification

Clarified position rules for syntax code E, C, V in Appendix B.

C.2 Changes from PR v1.3-2018 following TCG comments

Update of definitions

Q	meta.query	A query posed to an information system or database or a property of it

Changes of position indicator

Was

Q	phys.atmol.collisional	Related to collisions
Q	phys.virial	Related to virial quantities (mass, radius,..)

Changed to S to conform to the "Related to" definition and the usage of this UCD, mostly appearing as suffix.

S	phys.atmol.collisional	Related to collisions
S	phys.virial	Related to virial quantities (mass, radius,..)

C.3 Changes from WD v1.3-20160719

Added section 3 Remarks on combination rules for UCD words.

New terms

P	meta.ref.doi	DOI identifier (dereferenceable)

C.4 Changes from WD v1.23-20160719

Additions

S	arith.squared	Squared quantity
S	arith.sum	Summed or integrated quantity
S	arith.variation	Generic variation of a quantity
S	instr.voxel	Related to a voxel (n-D volume element with n>2)
Q	pos.outline	Set of points outlining a region (contour)
Q	stat.asymmetry	Measure of asymmetry
Q	phys.polarization.stokes.I	Stokes polarization coefficient I
Q	phys.polarization.stokes.Q	Stokes polarization coefficient Q
Q	phys.polarization.stokes.U	Stokes polarization coefficient U
Q	phys.polarization.stokes.V	Stokes polarization coefficient V
Q	stat.asymmetry	Measure of asymmetry
S	stat.fwhm	Full width at half maximum
S	stat.interval	Generic interval between two limits (defined as a pair of values)
P	stat.rank	Rank or order in list of sorted value
P	stat.rms	Root mean square Square root of sum of squared values or quadratic mean

Amendments/clarifications

Definition for

- `phys.area` Area (in surface, not angular units)
- `stat.stdev` Standard deviation as the square root of the variance

C.5 Changes from WD v1.23-20150608

Text of Abstract, last two lines. Added reference to Cecconi and Erard et al. (2014).

Section 1.1 Definition: "Abbreviations are used in contexts where their meaning is unambiguous" instead of "kept to a minimum..."

Amendments/clarifications

Description changed in words: `em.UV.10-50nm`, `em.UV.100-200nm`, `em.UV.200-300nm`, `meta.id.PI`, `phot.flux`, `phot.fluence`, `src.class`.

Additions

Q	`em.freq.cutoff`	Cutoff frequency
Q	`em.freq.resonance`	Resonance frequency
S	`em.pw`	Plasma waves (trapped in local medium)
S	`em.radio.20MHz`	Radio below 20 MHz
Q	`instr.experiment`	Experiment or group of instruments
Q	`meta.calibLevel`	Processing/calibration level
S	`meta.preview`	Related to a preview operation (for a dataset)
Q	`meta.query`	Related to query posed to an information system or database
Q	`meta.ref.ivoid`	An identifier following the IVOA Identifiers recommendation
S	`obs.calib.dark`	Related to dark current calibration
S	`obs.occult`	Observation of occultation phenomenon by solar system objects
S	`obs.transit`	Observation of transit phenomenon: exo-planets
E	`phot.radiance`	Radiance as energy flux per solid angle
S	`phys.aerosol`	Relative to aerosol
Q	`phys.density.phaseSpace`	Density in the phase space
S	`phys.dust`	Relative to dust
E	`phys.fluence`	Radiant photon energy received by a surface per unit area, or irradiance of a surface integrated over time of irradiation
Q	`phys.flux`	Flux or flow of particle, energy, etc.
Q	`phys.flux.energy`	Energy flux, heat flux
Q	`phys.mass.inertiaMomentum`	Momentum of inertia or rotational inertia
S	`phys.particle`	Related to physical particles
S	`phys.particle.neutron`	Related to neutron
S	`phys.particle.proton`	Related to proton
S	`phys.particle.alpha`	Related to alpha particle
S	`phys.phaseSpace`	Related to phase space
Q	`phys.potential`	Potential (electric, gravitational, etc.)
Q	`phys.size.smedAxis`	Linear semi median axis for 3D ellipsoids
Q	`phys.volume`	Volume (in cubic units)
Q	`pos.outline`	Set of points outlining a region (contour)
Q	`src.orbital.Tisserand`	Tisserand parameter (generic)
Q	`src.orbital.TissJ`	Tisserand parameter with respect to Jupiter
Q	`time.period.revolution`	Period of revolution of a body around a primary one (similar to year)
Q	`time.period.rotation`	Period of rotation of a body around its axis (similar to day)

Deletions/replacements

- deleted: em.UV.FUV
- deleted: phys.mol.qn; replaced by: phys.atmol.qn
- deleted: pos.bodyrc.long; replaced by: pos.bodyrc.lon
- deleted: pos.eop.nutation; replaced by: pos.nutation

Deprecated

- meta.ref.ivorn: The term IVORN should not be used any more for IVOA Identifiers (IVOIDs). In UCDs, meta.ref.ivoid should be used instead.

C.6 Changes from PR v1.22

Text of pararagraph 1.1 (2), last three lines;
List of em bands reordered according to wavelength/frequencies.

Amendments/clarifications

Description changed in words: phys.atmol.qn

Additions

em.line.Hdelta, em.line.Lyalpha, em.line.CO.

Deletions/replacements

- deleted: phys.mol.qn; replaced by: phys.atmol.qn

C.7 Changes from PR v1.21

Amendments/clarifications

- Syntax flag changed in words: phys.polarization
- Description changed in words: em.IR.FIR, em.IR.MIR, em.IR.NIR, em.line.OIII

C.8 Changes from PR v1.2

Additions

- spect.continuum

C.9 Changes from REC v1.11 (Rec20051231)

Amendments/clarifications

- Spelling: phys.atmol.sWeight
- Syntax flag changed in words: phys.atmol, spect.line
- Description changed in words: meta.dataset, obs.atmos, phot.color.reddFree, phys.size, phys.size.diameter, phys.size.radius, stat.param, stat.value, time, time.epoch, time.interval, time.period, time.phase.

Additions

em.bin, em.binSize, em.IR.FIR, em.IR.MIR, em.IR.NIR, em.UV.FUV, meta.abstract, meta.code.status, meta.email, meta.id.PI, meta.id.CoI, meta.ref.ivorn, meta.ref.uri, obs.calib.flat, obs.exposure, obs.proposal, obs.proposal.cycle, obs.sequence, phys.atmol.symmetry, phys.atmol.sWeight.nuclear, phys.cosmology, phys.damping, phys.entropy, phys.particle.neutrino, phys.virial, spect.line.strength, src.calib, src.calib.guideStar, src.net, stat.filling, stat.probability, stat.uncalib, time.creation, time.duration, time.end, time.processing, time.publiYear, time.release, time.star

Deletions/replacements

- deleted: `phys.atmol.damping`; replaced by: `phys.damping` with description: Atomic damping quantities (van der Waals)
- deleted: `phys.atmol.qn.I`; replaced by: `phys.atmol.qn` with description: Nuclear spin quantum number
- deleted: `time.event`; replaced by: `time.duration` with description: Duration of an event or phenomenon
- deleted: `time.event.end`; replaced by: `time.end` with description: End time of event or phenomenon
- deleted: `time.event.start`; replaced by: `time.start` with description: Start time of event or phenomenon
- deleted: `time.expo`; replaced by: `time.duration;obs.exposure` with description: Exposure on-time, duration
- deleted: `time.expo.end`; replaced by: `time.end;obs.exposure` with description: End time of exposure
- deleted: `time.expo.start`; replaced by: `time.start;obs.exposure` with description: Start time of exposure
- deleted: `time.obs`; replaced by: `time.duration;obs` with description: Observation on-time, duration
- deleted: `time.obs.end`; replaced by: `time.end;obs` with description: End time of observation
- deleted: `time.obs.start`; replaced by: `time.start;obs` with description: Start time of observation

C.10 Changes from v1.10

1. A few minor changes to the text have been done
2. All UCD words are now compliant with the UCD recommendation. The corresponding changes are described below
3. The following words have been deprecated:

Deprecated UCD	New corresponding UCD
`phot.fluxDens`	`phot.flux.density`
`phot.fluxDens.sb`	`phot.flux.density.sb`
`phys.at*`	`phys.atmol*`
`phys.atmol.coll`	`phys.atmol.collisional`
`phys.atmol.ion`	`phys.atmol.ionStage`
`phys.atmol.trans`	`phys.atmol.transition`
`phys.energyDensity`	`phys.energy.density`
`phys.massToLight`	`phys.composition.massLightRatio`
`phys.massYield`	`phys.composition.yield`
`spect.doppler`	`spect.dopplerParam`

4. The following word has been created: `phys.composition`
5. The section Changes from previous versions has been reformatted

C.11 Changes from v1.0

1. Descriptions have been changed for the following words: `em.line`, `instr.pixel`, `phys.gravity`, `pos.earth.altitude`
2. The syntax flags changed for words: `instr.filter`, `phys.angSize`
3. The following words have been deprecated:

Deprecated UCD	New corresponding UCD
`instr.filter.transm`	`phys.transm;instr.filter`
`phys.mass.light`	`phys.massToLight`
`pos.resolution`	`pos.angResolution`
`pos.satellite`	`pos.bodyrc`

4. The following words have been created: `phys.polarization.circular`, `phys.polarization.linear`, `phys.size.axisRatio`, `pos.bodyrc.alt`, `pos.bodyrc.lat`, `pos.bodyrc.long`, `time.event`, `time.event.end`, `time.event.start`.

C.12 Changes from v1.01

The following words have been restored to their previous spelling (v1.00):

phot.fluDensity, phys.energDensity, phys.mYield, phot.fluxDensity, phys.energyDensity, phys.massYield.

A note has been added to indicate that these words do not strictly comply with the UCD1+ Rec.

C.13 Changes from v1.00

1. Descriptions have been changed for the following words: em.IR.H, em.IR.J, em.IR.K, em.X-ray.hard, em.X-ray.medium, em.X-ray.soft, em.gamma.hard, em.gamma.soft, em.opt.B, em.opt.I, em.opt.R, em.opt.U, em.opt.V, instr.bandpass, phot.count, phys.density, phys.mol.dipole.electric, phys.mol.dipole.magnetic, phys.mol.quadrupole.electric, pos.angDistance, pos.precess, src, src.class.distance, src.class.richness, src.class.starGalaxy, src.class.struct, time.expo, time.expo.end, time.expo.start, time.interval
2. The following words have been deprecated:

Deprecated UCD	New corresponding UCD
instr.angRes	pos.resolution
instr.obsty.site	pos.earth.altitude;instr.obsty
instr.obsty.site.seeing	instr.obsty.seeing
instr.spect	instr
instr.spect.dispersion	instr.dispersion
instr.spect.order	instr.order
instr.spect.resolution	spect.resolution
instr.tel.focus	instr.tel.focalLength
meta.fits.software	meta.software
obs.air	obs.atmos
obs.air.extinction	obs.atmos.extinction
obs.air.mass	obs.airMass
phot.fluxDens	phot.fluDens
phot.fluxDens.sb	phot.fluDens.sb
phot.sb	phot.mag.sb
phys.at.branchingRatio	phys.atmol.branchingRatio
phys.at.crossSection	phys.atmol.crossSection
phys.at.lineShift	phys.atmol.lineShift
phys.at.moment	
phys.at.moment.electric	phys.at.radiationType
phys.at.moment.magnetic	phys.at.radiationType
phys.at.qn.S	phys.at.qn
phys.at.qn.L	phys.at.qn
phys.at.qn.J	phys.at.qn
phys.at.qn.F	phys.at.qn
phys.atmol.state.final	phys.atmol.final
phys.atmol.state.initial	phys.atmol.initial
phys.massYield	phys.mYield
phys.mol.quadrupole.magnetic	phys.at.radiationType
phys.refraction	phys.refractIndex
pos.az.ha	pos.eq.ha
pos.earth.nutation	pos.eop.nutation
spect.veloc	spect.dopplerVeloc
src.fwhm	phys.angSize;src
src.orbital.veloc	phys.veloc.orbital
src.veloc	phys.veloc
src.veloc.ang	phys.veloc.ang
src.veloc.cmb	phys.veloc;pos.cmb
src.veloc.dispersion	phys.veloc.dispersion
src.veloc.escape	phys.veloc.escape
src.veloc.expansion	phys.veloc.expansion

src.veloc.lg	phys.veloc;pos.lg
src.veloc.lsr	phys.veloc;pos.lsrv
src.veloc.microTurb	phys.veloc.microTurb
src.veloc.pulsat	phys.veloc.pulsat
src.veloc.rotat	phys.veloc.rotat

3. The syntax flags changed for words: instr.fov, instr.obsty, meta.file, phys.angSize, pos.cartesian, stat.fit.omc
4. The following words have been created: instr.dispersion, instr.order, instr.tel.focalLength, meta.curation, meta.software, meta.version, obs.atmos, obs.atmos.extinction, obs.airMass, obs.atmos.refractAngle, obs.calib, phys.at.radiationType, phys.atmol.branchingRatio, phys.atmol.crossSection, phys.atmol.lifetime, phys.atmol.lineShift, phys.energDensity, phys.refractIndex, phys.transmission, pos.eq.ha, pos.az.azi, pos.bodyrc, pos.cmb, pos.earth.altitude, pos.eop, pos.eop.nutation, pos.lg, pos.lsr, pos.phaseAng, pos.resolution, spect.resolution, spect.dopplerVeloc, spect.dopplerVeloc.radio, spect.dopplerVeloc.opt, src.orbital.meanMotion, phys.veloc, phys.veloc.ang, phys.veloc.dispersion, phys.veloc.escape, phys.veloc.expansion, phys.veloc.microTurb, phys.veloc.orbital, phys.veloc.pulsat, phys.veloc.rotat, phys.veloc.transverse, time.obs, time.obs.end, time.obs.start.

C.14 Changes from v0.2

1. Section 1.2 has been simplified
2. new syntax codes (E, C, V) have been introduced, and described in appendix A
3. The following words have been renamed

Deprecated UCD	New corresponding UCD
em.line.21cm	em.line.HI
instr.ang-res	instr.angRes
instr.sky-level	instr.skyLevel
instr.sky-temp	instr.skyTemp
instr.antenna-temp	phot.antennaTemp
phys.absorption.gf	phys.gauntFactor
phys.at.einstein	phys.at.transProb
phys.at.level	phys.atmol.level
phys.dispMeas	phys.dispMeasure
phys.distance	pos.distance
phys.polarization.rotMeas	phys.polarization.rotMeasure
phys.size.area	phys.area
pos.ang.separation	pos.angDistance
pos.ec	pos.ecliptic
pos.ec.lat	pos.ecliptic.lat
pos.ec.lon	pos.ecliptic.lon
pos.ee	pos.errorEllipse
pos.gal	pos.galactic
pos.gal.lat	pos.galactic.lat
pos.gal.lon	pos.galactic.lon
pos.sg	pos.supergalactic
pos.sg.lat	pos.supergalactic.lat
pos.sg.lon	pos.supergalactic.lon
src.class.star-galaxy	src.class.starGalaxy

4. The following words have been created: instr.beam, meta.code.error, meta.id.part, phot.flux.sb, phys.angArea, phys.angSize, phys.angSize.smajAxis, phys.angSize.sminAxis, phys.area, phys.at.damping, phys.at.weight, phys.atmol.excitation, phys.mol.dissociation, phys.recombination.coeff, phys.size.smajAxis, phys.size.sminAxis, pos.cartesian, pos.cartesian.x, pos.cartesian.y, pos.cartesian.z, pos.distance, pos.eq.spd, pos.galactocentric, pos.geocentric, pos.healpix, pos.heliocentric, pos.HTM, pos.lambert, pos.satellite, spect.line.broad.Stark, spect.veloc, src.redshift.phot, stat.correlation,

time.lifetime.

5. Some words have been removed. The following table summarizes, when relevant, the suggested replacement to be used.

Deprecated UCD	New corresponding UCD
instr.area	phys.area;instr
instr.beam-width	phys.angSize;instr.beam
meta.table.axis	phys.size;meta.table
phot.color.Cous	phot.color
phot.color.Gen	phot.color
phot.color.Gunn	phot.color
phot.color.JHN	phot.color
phot.color.STR	phot.color
phot.color.STR.c1	phot.color
phot.color.STR.b-y	phot.color
phot.color.STR.m1	phot.color
phys.at.lineBroad	spect.line.broad
phys.distance.compon	pos.distance;pos.cartesian.x (or y, z)
phys.distance.gc	pos.distance;pos.galactocentric
phys.electron.energy	phys.energy;phys.electron
phys.extension	phys.angSize or phys.size
phys.mass.fraction	phys.mass;arith.ratio
phys.polarization.posAng	pos.posAng;phys.polarization
pos.ang	
pos.det	pos.cartesian;instr.det
pos.eq.dec.arcsec	
pos.eq.ra.minutes	
pos.eq.ra.seconds	
pos.gal.compon	pos.cartesian;pos.galactic
pos.pm.dec	pos.pm;pos.eq.dec
pos.pm.ra	pos.pm;pos.eq.ra
pos.precess.dec	pos.precess;pos.eq.dec
pos.precess.ra	pos.precess;pos.eq.ra
pos.proj	
pos.sg.compon	pos.cartesian;pos.supergalactic
src.orbital.energy	phys.energy;src.orbital
src.orbital.separation	pos.angDistance;src.orbital
src.orbital.size	phys.size;src.orbital
src.separation	pos.angDistance;src
src.veloc.compon	src.veloc;pos.cartesian
src.veloc.gc	src.veloc;pos.galactocentric
src.veloc.geoc	src.veloc;pos.geocentric
src.veloc.hc	src.veloc;pos.heliocentric

C.15 Changes from v0.1

1. Descriptions of the words were improved.
2. Designation of commonly used lines have been moved to em.line.*. As a consequence, terms like em.IR.K.Brgamma or spect.index.Hbeta have been removed.
3. phys.at and phys.mol have been completely reorganized to improve the overall description of this domain. A new branch phys.atmol has been introduced to group concepts shared between phys.at and phys.mol.
4. The phot.color section was significantly simplified.
5. Missing nodes of the tree were added (e.g. em.gamma, em.mm, pos.sg).
6. Creation of new words: em.wavenumber, meta.ucd, stat.error.sys.
7. Typos were corrected in em.opt.* units and a few other descriptions.

References

Cecconi, B., Erard, S., André, N., Jacquey, C., Génot, V., Henry, F., Bonnin, X., Le Sidaner, P., Chauvin, C., Fuller, N., Braga, V. F., Aboudarham, J., Louys, M., Derrière, S., Preite Martinez, A. and Ochsenbein, F. (2014), 'Solar System UCDs: Assessment Study of Unified Content Descriptors (UCDs) for the Solar System Resources (Planetary sciences and Heliophysics)', IVOA Internal Technical Note.
http://wiki.ivoa.net/internal/IVOA/PlanetaryUCD/SolarSystemUCD-V06.pdf

Derriere, S., Gray, N., Mann, R., Preite Martinez, A., McDowell, J., McGlynn, T., Ochsenbein, F., Osuna, P., Rixon, G. and Williams, R. (2004), 'UCD (Unified Content Descriptor) – moving to UCD1+', IVOA Recommendation.
http://www.ivoa.net/documents/latest/UCD.html

Erard, S., Cecconi, B. and Le Sidaner, P. (2019), 'EPN-TAP: Publishing Solar System Data to the Virtual Observatory', IVOA Working Draft 2019 April 2.

Erard, S., Cecconi, B., Le Sidaner, P., Rossi, A. P., Capria, M. T., Schmitt, B., Génot, V., André, N., Vandaele, A. C., Scherf, M., Hueso, R., Maatanen, A., Thuillot, W., Carry, B., Achilleos, N., Marmo, C., Santolík, O., Benson, K. M., Fernique, P., Beigbeder, L., Rousseau, B., Andrieu, F., Chauvin, C., Minin, M., Ivanovski, S. L., Longobardo, A., Albert, D., Gangloff, M., Jourdane, N., Bouchemit, M., Glorian, J.-M., Trompet, L., Al-Ubaidi, T., Juaristi, J., Desmars, J., Guio, P., Delaa, O., Lagain, A., Souček, J. and Pisa, D. (2018), 'VESPA: a community-driven Virtual Observatory in Planetary Science ', *Planet. Space Sci.* **150**, 65–68.
http://doi.org/10.1016/j.pss.2017.05.013

Genova, F., Louys, M., Preite Martinez, A., Cecconi, B., Derrière, S., Molinaro, M., Delmotte, N., Gray, N., Mann, R., McDowell, J., Mc Glynn, T., Ochsenbein, F., Osuna, P., Rixon, G., Williams, R. and the IVOA Semantics Working Group (2019), 'Maintenance of the list of UCD words', IVOA Recommendation.
http://www.ivoa.net/documents/UCDlistMaintenance/