

TimeSeries utypes



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acknowledges the whole IVOA TimeSeries task group chaired
by Ada Nebot



TimeSeries utypes status since Victoria

Updating utypes versus the unified data model

Creating the examples for the three flavors of
Gaia DR2 timeSeries (ESA, VizieR, GAVO)

Proposal for deriving and storing utypes



GAIADR TimeSeries : ESA case metadata

Table Parameters for 1: GAIADR2utypes.xml

Name	Value	Units	Description	UCD	Utype
Name	metadata		Table name		
Column Count	7		Number of columns		
Row Count	3		Number of rows		
Description	This table contains all generic metadata of the TimeSeries.				
productType	TimeSeries				ts:SimpleTimeSeries.ObsDataSet.dataProductType
calibLevel	4				ts:SimpleTimeSeries.ObsDataSet.calibLevel
Target	Gaia DR2 6680733225618222592				ts:SimpleTimeSeries.ObsDataSet.Target.name
pubDID	ivo://esac/Gaia#GaiaDR2-6680733225618222592-TS				ts:SimpleTimeSeries.ObsDataSet.Curation.PubDID
creator	ESA				ts:SimpleTimeSeries.ObsDataSet.DataID.creator
contributor	CDS				ts:SimpleTimeSeries.ObsDataSet.dataID.contributor
SpatLocationRA	307.6583	deg	pos.eq.ra		ts:SimpleTimeSeries.ObsDataSet.Char.SpatialAxis.Coverage.Location.Coord.EquatorialCoord.ra.value
SpatLocationDEC	-40.00379	deg	pos.eq.dec		ts:SimpleTimeSeries.ObsDataSet.Char.SpatialAxis.Coverage.Location.Coord.EquatorialCoord.dec.value
SpatBoundsSizeRA	1.0E-6	deg	pos.eq.ra:stat.length		ts:SimpleTimeSeries.ObsDataSet.Char.Coverage.SpatialAxis.Bounds.CharBox.Size2.ra
SpatBoundsSizeDEC	1.0E-6	deg	pos.eq.dec:stat.length		ts:SimpleTimeSeries.ObsDataSet.Char.Coverage.SpatialAxis.Bounds.CharBox.Size2.dec
t_min	2456953.0	d	time.start		ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.bounds.StartTime;JD.date
t_max	2456982.8	d	time.stop		ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.bounds.StopTime;JD.date
t_mean	2456967.0	d	time		ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.location.coord.JD.date
t_exp_time	132.0	s	time.duration		ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.support.Extent
t_resolution	0.03	ms	time.resolution		ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.resolution.RefVal
delta_t_min	0.08	d	time		ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.sampling.bounds.SamplingPrecision.TimeStart
delta_t_max	20.0	d	time		ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.sampling.bounds.SamplingPrecision.TimeStop
em_min	3283.0	m	em.wl:sta.min		ts:SimpleTimeSeries.ObsDataSet.Char.SpectralAxis.Coverage.Bounds.Limits.LoLimit
em_max	10637.0	m	em.wl:stat.min		ts:SimpleTimeSeries.ObsDataSet.Char.SpectralAxis.Coverage.Bounds.Limits.HiLimit
TimeScale	TCB		time		ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.TimeFrame.timescale
refPositionT	BARYCENTER		pos		ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.TimeFrame.refPosition
TimeOrigin	2455197.5	d	time.epoch		ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.time0;JD.date
SpaceRefFrame	ICRS		pos		ts:SimpleTimeSeries.SpaceFrame.spaceRefFrame
refPositionS	BARYCENTER		pos		ts:SimpleTimeSeries.SpaceFrame.refPosition

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List

- 1: GAIADR2utypes.xml
- 2: GAIADR2utypes.xml-2

Current Table Properties

Label: GAIADR2utypes.xml
 Location: /home/bonnarell/Documents/OV/TimeDomainDir/VOLUTE/time-
 Name: metadata
 Rows: 3
 Columns: 7
 Sort Order:
 Row Subset: All
 Activation Action: [no action] Broadcast Row

SAMP

Messages: Clients:

129 / 3540 M

TOPCAT(1): Table Browser

Window Subsets Help

Table Browser for 1: GAIADR2utypes.xml

Filterid...	TransCurve	TransCurveE...	gTransCurve...	gTransCurve...	PhotM...	PhotMageZe...
1 G	http://svo2.cab.inta-csic.es/theory/fps/fps.php...	5857, 6	3321,	10515,	Vega	2861, 3032
2 BP	http://svo2.cab.inta-csic.es/theory/fps/fps.php...	5044, 4	3283,	6714,	Vega	3478, 79785
3 RP	http://svo2.cab.inta-csic.es/theory/fps/fps.php...	7692, 2	6296,	10637,	Vega	2461, 21805

GAIATimeSeries : ESA case data

TOPCAT(2): Table Browser

Window Subsets Help

Table Browser for 2: GAIADR2types.xml-2

	source_id	transit_id	band	time	mag	flux	flux_error	flux_over_error	rejecte...	rejecte...	other_fl...	solution_id
1	6680733225618222592	17714070537773976	G	1717.19721	13.1423	1.04330E5	52.233	1997.4			1	369295549951641967
2	6680733225618222592	17718162802643027	G	1717.27122	13.1469	1.03891E5	122.241	849.891			4097	369295549951641967
3	6680733225618222592	19587748378317018	G	1751.07879	13.152	1.03405E5	88.0148	1174.86			4097	369295549951641967
4	6680733225618222592	215354209996141763	G	1786.29822	13.1441	1.04160E5	79.7522	1306.05			4194817	369295549951641967
5	6680733225618222592	22272415744454690	G	1799.62542	13.1489	1.03703E5	168.811	614.315			4097	369295549951641967
6	6680733225618222592	22282156538335280	G	1799.80156	13.1446	1.04114E5	66.4145	1567.64			1	369295549951641967
7	6680733225618222592	22286248876742047	G	1799.87556	13.1458	1.03998E5	95.7815	1085.79			4097	369295549951641967
8	6680733225618222592	27402073789441945	G	1892.39268	13.1454	1.04037E5	207.728	500.832			4097	369295549951641967
9	6680733225618222592	27406166091945222	G	1892.46669	13.158	1.02837E5	132.836	774.168			4097	369295549951641967
10	6680733225618222592	28190274394026834	G	1906.64797	13.1541	1.03204E5	100.269	1029.27			4097	369295549951641967
11	6680733225618222592	28194366654440364	G	1906.72199	13.1569	1.02943E5	89.9419	1144.55			4097	369295549951641967
12	6680733225618222592	30155932650608147	G	1942.19913	13.1584	1.02801E5	90.3379	1137.96			4097	369295549951641967
13	6680733225618222592	30165673459742559	G	1942.3753	13.1611	1.02543E5	86.103	1190.94			1	369295549951641967
14	6680733225618222592	37548515102179683	G	2075.89347	13.1516	1.03441E5	90.6643	1140.92			4194817	369295549951641967
15	6680733225618222592	37552607401525855	G	2075.96748	13.1518	1.03424E5	82.8096	1248.94			4194817	369295549951641967
16	6680733225618222592	38461216991880082	G	2092.39801	13.1585	1.02788E5	75.0804	1369.04			1	369295549951641967
17	6680733225618222592	38465309274853809	G	2092.47201	13.1603	1.02620E5	71.3564	1438.13			1	369295549951641967
18	6680733225618222592	42637190629463112	G	2167.9118	13.1493	1.03664E5	106.602	972.441			4097	369295549951641967
19	6680733225618222592	42646931599529264	G	2168.08793	13.1464	1.03943E5	47.8759	2171.1			1048577	369295549951641967
20	6680733225618222592	42651023935452951	G	2168.16195	13.149	1.03689E5	143.01	725.048			4097	369295549951641967
21	6680733225618222592	42660764831326678	G	2168.3381	13.143	1.04269E5	91.0798	1144.81			4097	369295549951641967
22	6680733225618222592	42664857139463283	G	2168.41207	13.1439	1.04184E5	62.0304	1679.57			4194817	369295549951641967
23	6680733225618222592	42674597970587877	G	2168.58824	13.1428	1.04281E5	368.299	283.143			4609	369295549951641967
24	6680733225618222592	42688431043134047	G	2168.83836	13.1422	1.04345E5	75.6386	1379.52			4194817	369295549951641967
25	6680733225618222592	42702264071116355	G	2169.08854	13.1408	1.04483E5	133.692	781.52			4097	369295549951641967
26	6680733225618222592	42716097072616619	G	2169.33869	13.144	1.04175E5	38.9278	2676.11			1	369295549951641967
27	6680733225618222592	42720189329891891	G	2169.41269	13.1452	1.04055E5	37.8802	2746.93			1	369295549951641967
28	6680733225618222592	42729930070316389	G	2169.58883	13.1463	1.03950E5	56.0703	1853.93			1	369295549951641967
29	6680733225618222592	42734022331392922	G	2169.66284	13.1472	1.03861E5	65.0009	1597.83			1	369295549951641967
30	6680733225618222592	42743763083870351	G	2169.83895	13.15	1.03595E5	212.344	487.867			4461057	369295549951641967
31	6680733225618222592	4274785352424278	G	2169.91298	13.1477	1.03812E5	176.603	589.631			4097	369295549951641967
32	6680733225618222592	42757596135704045	G	2170.0891	13.1496	1.03639E5	112.595	920.46			4198913	369295549951641967
33	6680733225618222592	4276...										
34	6680733225618222592	4277...										

TOPCAT(2): Table Columns

Window Columns Display Help

Table Columns for 2: GAIADR2types.xml-2

	Name	Units	UCD	Utype	Datatype
0	Index				
1	source_id		meta.id;meta.main	ts:SimpleTimeSeries.ObsDataSet.Target.name	long
2	transit_id		meta.version		long
3	band		instr.bandpass	ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.PhotometryFilter.bandName	char
4	time	d	time.epoch	ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.time	double
5	mag	mag	phot.mag;em.opt	ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.Mag.value	float
6	flux	e-/s	em.opt;phot.flux;stat.mean	ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.Flux.value	float
7	flux_error	e-/s	em.opt;phot.flux;stat.error	ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.error.statError;Symmetrical1D.radius	float
8	flux_over_error		stat.SNR;em.opt;phot.flux;		float
9	rejected_by_photometry		meta.code.status		boolean
10	rejected_by_variability		meta.code.status		boolean
11	other_flags		meta.code.status		long
12	solution_id		meta.version		long

124 / 3540 M

Bitmap sélectionné(e)(s) 0,40 / 5,20 27,09 x 15,17 Diapo 1 / 6 Standard

GAIA TimeSeries : VizierR case data

The screenshot displays the TOPCAT software interface with three main windows:

- Table Browser for 4: VizierR-Gaia-6680733225618222592utypes**: Shows a table with 43 rows and 4 columns: Index, JD-2455197.5, Gmag [mag], and err. The data shows a decreasing trend in JD-2455197.5 and Gmag over time.
- Table Columns for 4: VizierR-Gaia-6680733225618222592utypes.xml-2**: Shows the column definitions for the table.
- Table List**: Lists the current table and other tables in the workspace.
- Current Table Properties**: Shows the table's label, location, name, rows, and columns.

Index	"JD-2455197.5"	Gmag [mag]	err
1	1717.2	13.1423	0.000544
2	1717.27	13.1469	0.001278
3	1751.08	13.152	0.000924
4	1786.3	13.1441	0.000831
5	1799.63	13.1489	0.001767
6	1799.8	13.1446	0.000693
7	1799.88	13.1458	0.001
8	1892.39	13.1454	0.002168
9	1892.47	13.158	0.001402
10	1906.65	13.1541	0.001055
11	1906.72	13.1569	0.000949
12	1942.2	13.1584	0.000954
13	1942.38	13.1611	0.000912
14	2075.89	13.1516	0.000952
15	2075.97	13.1518	0.000869
16	2092.4	13.1585	0.000793
17	2092.47	13.1603	0.000755
18	2167.91	13.1493	0.001117
19	2168.09	13.1464	0.00095
20	2168.16	13.149	0.001497
21	2168.34	13.143	0.000948
22	2168.41	13.1439	0.000646
23	2168.59	13.1428	0.003835
24	2168.84	13.1422	0.000787
25	2169.09	13.1408	0.001389
26	2169.34	13.144	0.000406
27	2169.41	13.1452	0.000395
28	2169.59	13.1463	0.000586
29	2169.66	13.1472	0.00068
30	2169.84	13.15	0.002225
31	2169.91	13.1477	0.001841
32	2170.09	13.1496	0.00118
33	2170.16	13.1517	0.000779
34	2170.34	13.1515	0.000776
35	2170.41	13.15	0.000976
36	2170.59	13.1656	0.004349
37	2170.66	13.1552	0.002135
38	2170.91	13.1531	0.000886
39	2266.44	13.1382	0.000899
40	2266.51	13.1422	0.000943
41	2286.69	13.1415	0.002237
42	2286.76	13.143	0.000716
43	2318.25	13.1448	0.001533



GAIA TimeSeries : GAVO case data

TOPCAT(7): Table Browser

Window Subsets Help

Table Browser for 7: GAVO-Gaia-6680733225618222592-Gutypes.xml

	obs time	flux	mag	flux_error
7	2,456997E6	1,03998E5	13,1458	95,7815
8	2,457090E6	1,04037E5	13,1454	207,728
9	2,457090E6	1,02837E5	13,158	132,836
10	2,457104E6	1,03204E5	13,1542	100,269
11	2,457104E6	1,02943E5	13,1569	89,9419
12	2,457140E6	1,02801E5	13,1584	90,3379
13	2,457140E6	1,02543E5	13,1611	86,103
14	2,457273E6	1,03441E5	13,1517	90,6643
15	2,457273E6	1,03424E5	13,1518	82,8096
16	2,457290E6	1,02788E5	13,1585	75,0804
17	2,457290E6	1,02620E5	13,1603	71,3564
18	2,457365E6	1,03664E5	13,1493	106,602
19	2,457366E6	1,03943E5	13,1464	47,8759
20	2,457366E6	1,03689E5	13,1491	143,01
21	2,457366E6	1,04269E5	13,143	91,0798
22	2,457366E6	1,04184E5	13,1439	62,0304
23	2,457366E6	1,04281E5	13,1429	368,299
24	2,457366E6	1,04345E5	13,1422	75,6386
25	2,457367E6	1,04483E5	13,1408	133,692
26	2,457367E6	1,04175E5	13,144	38,9278
27	2,457367E6	1,04055E5	13,1452	37,8802
28	2,457367E6	1,03950E5	13,1463	56,0703
29	2,457367E6	1,03861E5	13,1473	65,0009
30	2,457367E6	1,03595E5	13,1501	212,344
31	2,457367E6	1,03812E5	13,1478	176,063
32	2,457368E6	1,03639E5	13,1496	112,595
33	2,457368E6	1,03437E5	13,1517	74,2038
34	2,457368E6	1,03452E5	13,1516	73,9295
35	2,457368E6	1,03595E5	13,1501	93,1606
36	2,457368E6	1,02121E5	13,1656	409,062
37	2,457368E6	1,03107E5	13,1552	202,722
38	2,457368E6	1,03304E5	13,1531	84,309
39	2,457464E6	1,04727E5	13,1383	86,694
40	2,457464E6	1,04345E5	13,1422	90,5845
41	2,457484E6	1,04412E5	13,1415	215,11
42	2,457484E6	1,04263E5	13,1431	68,8041
43	2,457516E6	1,04098E5	13,1448	147,026
44	2,457516E6	1,03901E5	13,1469	148,307

TOPCAT

File Views Graphics Joins Windows VO Interop Help

Table List

7: GAVO-Gaia-6680733225

Current Table Properties

Label: GAVO-Gaia-6680733225618222592-Gutypes.xml
 Location: /home/bonnarell/Documents/OV/TimeDomainDir/VOLUTE/time-series/note/DATA/Proposed_Serializations/UTYPES/GAVO-Gaia-6680733225618222592-Gutypes.xml
 Name: ndweespaslha
 Rows: 44
 Columns: 4
 Sort Order:
 Row Subset: All
 Activation Action: (no action) Broadcast Row

TOPCAT(7): Table Columns

Window Columns Display Help

Table Columns for 7: GAVO-Gaia-6680733225618222592-Gutypes.xml

	Name	Units	UCD	Utype	Datatype
0	Index				
1	obs time	d	time.epoch	ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.time	double
2	flux	e-/s	phot.flux;em.opt.V	ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.Flux.value	float
3	mag	mag	phot.mag;em.opt.V	ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.Mag.value	float
4	flux_error	e-/s	stat.error;phot.flux;em.opt.V	ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.error.statError;SymmetricalID.radius	float



How to derive utypes ?

Start from Vodml instance serialisation (Mapping)

Choose one or several « starting points »

Follow the branches down and store the vodml-roles of the leaves

When there is a reference :

- internal to the model ---> just concatenate the vodml-roles
- External : either concatenate or separate the new branch

When derived store them in a semantic-like list (value description, vodml-roles)

Use vosi tablesets as a reference for utypes for a family of similar instances of TimeSeries (« instance template »)



Metadata :

DataSet, DataID, Char utypes

DataSet General

ts:SimpleTimeSeries.Obsdataset.dataProductType

ts:SimpleTimeSeries.Obsdataset.calibLevel

ts:SimpleTimeSeries.ObsDataSet.Target.name

DataSet DataID

ts:SimpleTimeSeries.ObsDataSet.DataId.datasetID

ts:SimpleTimeSeries.ObsDataSet.DataID.creator

ts:SimpleTimeSeries.ObsDataSet.DataID.contributor

Characterization

ts:SimpleTimeSeries.ObsDataSet.Char.SpatialAxis.Coverage.Location.Coord.EquatorialCoord.ra.value

ts:SimpleTimeSeries.ObsDataSet.Char.SpatialAxis.Coverage.Location.Coord.EquatorialCoord.dec.value

ts:SimpleTimeSeries.ObsDataSet.Char.SpatialAxis.Coverage.Bounds.CharBox.Size2.ra

ts:SimpleTimeSeries.ObsDataSet.Char.SpatialAxis.Coverage.Bounds.CharBox.Size2.dec

ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.bounds.StartTime;JD.date

ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.bounds.StopTime;JD.date

ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.location.coord.JD.date

ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.Coverage.support.Extent

ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.resolution.RefVal

ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.sampling.bounds.SamplingPrecision.TimeStart

ts:SimpleTimeSeries.ObsDataSet.Char.TimeAxis.sampling.bounds.SamplingPrecision.TimeStop

ts:SimpleTimeSeries.ObsDataSet.Char.SpectralAxis.Coverage.Bounds.Limits.LoLimit

ts:SimpleTimeSeries.ObsDataSet.Char.SpectralAxis.Coverage.Bounds.Limits.HiLimit



Metadata :

Coordinate systems

Coordinate System Time

ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.TimeFrame.timescale

ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.TimeFrame.refPosition

ts:SimpleTimeSeries.TsPoint.SampleTime.StdTimeMeasure.TimeOffset.time0;JD.date

Coordinate System Space

ts:SimpleTimeSeries.SpaceFrame.spaceRefFrame

ts:SimpleTimeSeries.SpaceFrame.refPosition



Metadata :

Photometric system utype

Photometric System

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.PhotometryFilter.bandName

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.PhotometryFilter.

transmissionCurve.access.reference

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.PhotometryFilter.

SpectralLocation.value

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotometryFilter.bandwidth.start

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotometryFilter.bandwidth.stop

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.magnitudeSystem.type

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.zeroPoint.flux.value



Data :

Measurement utypes

Data

ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.time

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.Mag.value

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.Flux.value

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.error.statError;Symmetrical1D.radius



Storing utypes with description and vodml definitions (could be done in xml or rdf?)

Examples :

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.PhotometryFilter.bandName

Desc : this tags the bandName of the PhotometryFilter used in calibration of the PhotometricMeasure of a TimeSeries Point in the Time Series

Vo-dml roles : ts :SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.

Photdm : PhotCal.PhotometryFilter.bandName

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.PhotometryFilter.transmissionCurve.access.reference

Desc : this tags the url of the transmission curve of the PhotometryFilter used in calibration of the PhotometricMeasure of a TimeSeries Point in the Time Series

Vo-dml roles : ts :SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.

Photdm : PhotCal.PhotometryFilter.transmissionCurve.access.reference

ts:SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.PhotCal.zeroPoint.flux.value

Desc : this tags the zero Point of the Photometric system used in calibration of the PhotometricMeasure of a TimeSeries Point in the Time Series

Vo-dml roles : ts :SimpleTimeSeries.TSPoint.Observable.PhotometricMeasure.

Photdm : PhotCal.zeroPoint.flux.value



VO tableset
For GAVO
TimeSeries
instances

```
- <table type="output">
  <name>random</name>
  <description>instance of TimeSeries data class </description>
  - <column>
    <name>obs_time</name>
    <dataType xsi:type="vod:TAPType">DOUBLE</dataType>
    <ucd>time.epoch</ucd>
    <unit>d</unit>
  - <utype>
    ts:SimpleTimeSeries.TSPoint.SampleTime.StdTimeMeasure.TimeOffset.time
  </utype>
</column>
- <column>
  <name>flux</name>
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- <column>
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  <ucd>em.opt.B;phot.flux;stat.error</ucd>
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  </utype>
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