International

Virtual

Observatory

Alliance

VO-DML: a proposal for a consistent modelling language for IVOA data models

Version 1.0-20130510

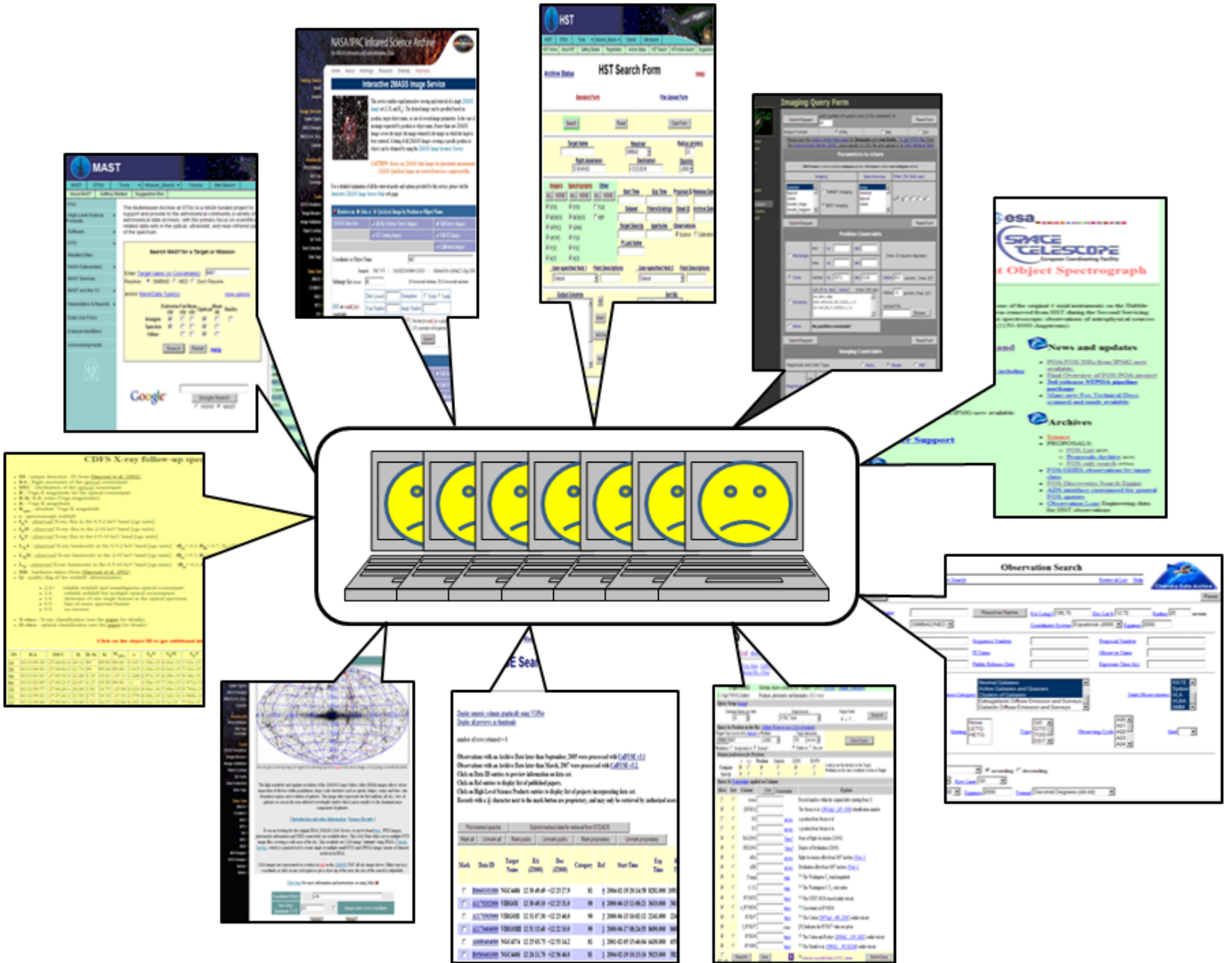
Working Draft 2013 May 10

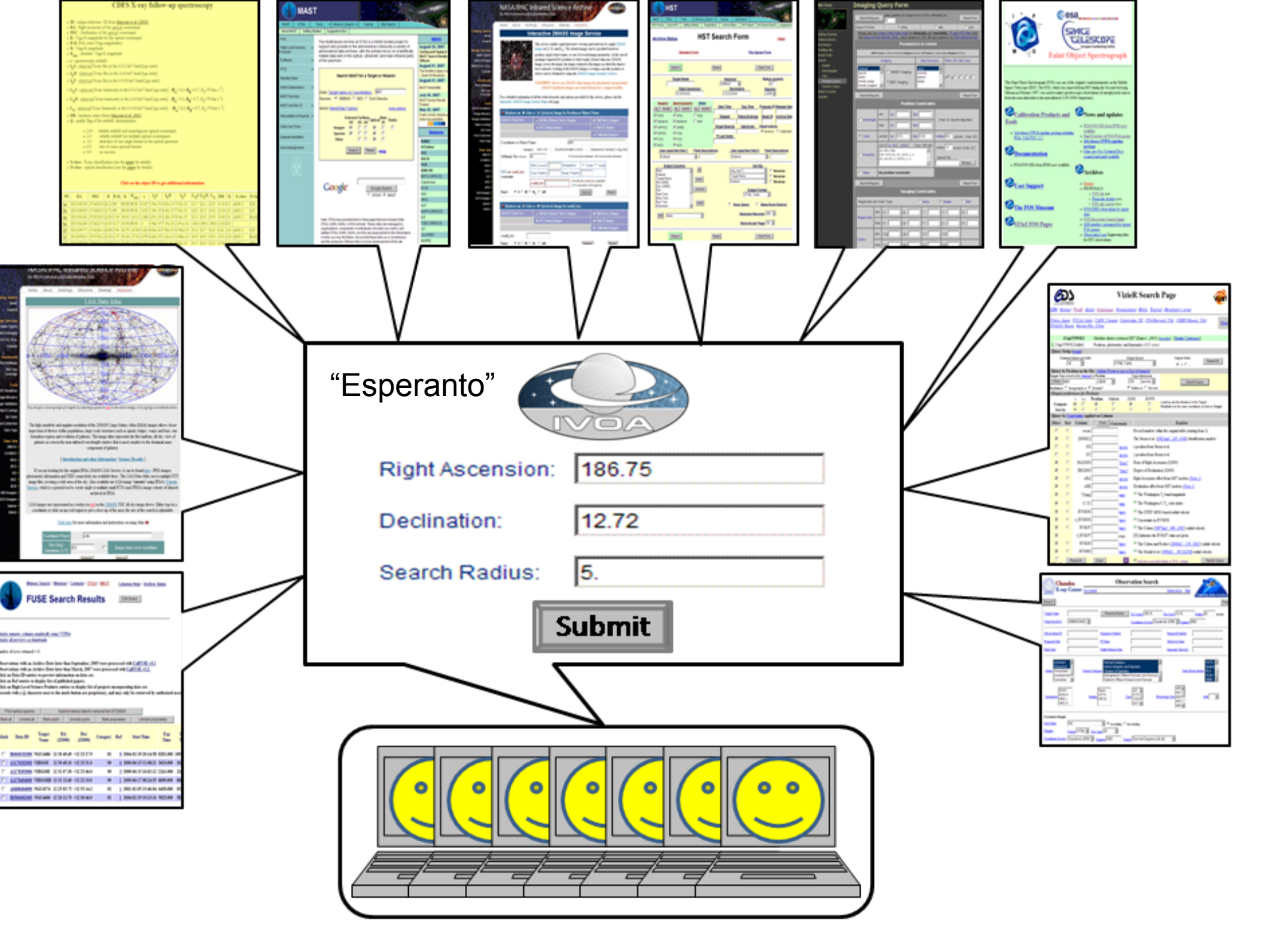
DRAFT

Why we need something like it,
and why we need it for utypes

Gerard Lemson, MPA
UTYPEs tiger team

Goal of VO: resolve Babylonian confusion




"Esperanto"
IVOA
Right Ascension:
186.75
Declination:
12.72
Search Radius:
5.
Submit
HST Search Form
FUSE Search Results
VizieR Search Page
Observation Search

Where do data models come in?

Understanding common components in diverse data sets with.

Posing correct and meaningful queries.

Understanding results.

Understanding the world of the IVOA, its “universe of discourse”

2mass

designation	ra	dec	clon	clat	err_maj	err_min	err_ang	j_m	j_cmsig	j_msigcom	j_snr	h_m	h_cmsig	h_msigcom
char	double	double	char	char	double	double	int	double	double	double	double	double	double	double
	deg	deg			arcsec	arcsec	deg	mag	mag	mag		mag	mag	mag
null	null	null	null	null	null	null	null	null	null	null	null	null	null	null
00424416+4116152	10.684029	41.270901	00h42m44.17s	41d16m15.24s	0.13	0.12	111	10.063	null	null	null	9.359	null	null
00424414+4116000	10.683944	41.266682	00h42m44.15s	41d16m00.06s	0.13	0.12	93	12.565	0.054	0.055	306.5	9.510	null	null
00424377+4116045	10.682383	41.267925	00h42m43.77s	41d16m04.53s	0.10	0.09	69	12.446	0.060	0.061	342.0	11.753	0.062	0.063
00424484+4116145	10.686846	41.270714	00h42m44.84s	41d16m14.57s	0.13	0.11	61	12.872	0.060	0.061	231.0	9.433	null	null
00424487+4116005	10.686963	41.266827	00h42m44.87s	41d16m00.58s	0.10	0.09	93	10.450	null	null	null	12.094	0.032	0.033
00424502+4116130	10.687611	41.270302	00h42m45.03s	41d16m13.09s	0.18	0.14	173	13.055	0.108	0.109	195.2	9.504	null	null
00424446+4116016	10.685270	41.267124	00h42m44.46s	41d16m01.65s	0.13	0.12	90	12.070	0.033	0.035	483.5	9.301	null	null
00424464+4116106	10.686015	41.269630	00h42m44.64s	41d16m10.67s	0.13	0.12	90	9.399	null	null	null	9.985	0.070	0.070
00424464+4116092	10.686026	41.269226	00h42m44.65s	41d16m09.21s	0.13	0.12	90	9.299	null	null	null	8.606	null	null
00424403+4116108	10.683465	41.269676	00h42m44.03s	41d16m10.83s	0.13	0.11	119	11.507	0.055	0.056	812.1	8.744	null	null
00424433+4116085	10.684737	41.269035	00h42m44.34s	41d16m08.53s	0.08	0.07	87	9.453	0.051	0.052	5385.6	8.668	0.050	0.051
00424455+4116103	10.685657	41.269550	00h42m44.56s	41d16m10.38s	0.13	0.12	90	10.773	0.067	0.069	1596.7	8.532	null	null
00424497+4116034	10.687414	41.267632	00h42m44.98s	41d16m03.48s	0.13	0.12	93	12.371	0.034	0.036	366.5	9.627	null	null
00424420+4116009	10.684180	41.266941	00h42m44.20s	41d16m00.99s	0.13	0.12	101	10.065	null	null	null	9.374	null	null
00424386+4116123	10.682777	41.270111	00h42m43.87s	41d16m12.40s	0.10	0.09	111	9.977	null	null	null	11.683	0.056	0.056
00424398+4116028	10.683263	41.267456	00h42m43.98s	41d16m02.84s	0.13	0.12	79	12.136	0.038	0.040	455.0	9.226	null	null
00424385+4116014	10.682713	41.267056	00h42m43.85s	41d16m01.40s	0.13	0.12	69	10.176	null	null	null	11.876	0.049	0.050

sdss

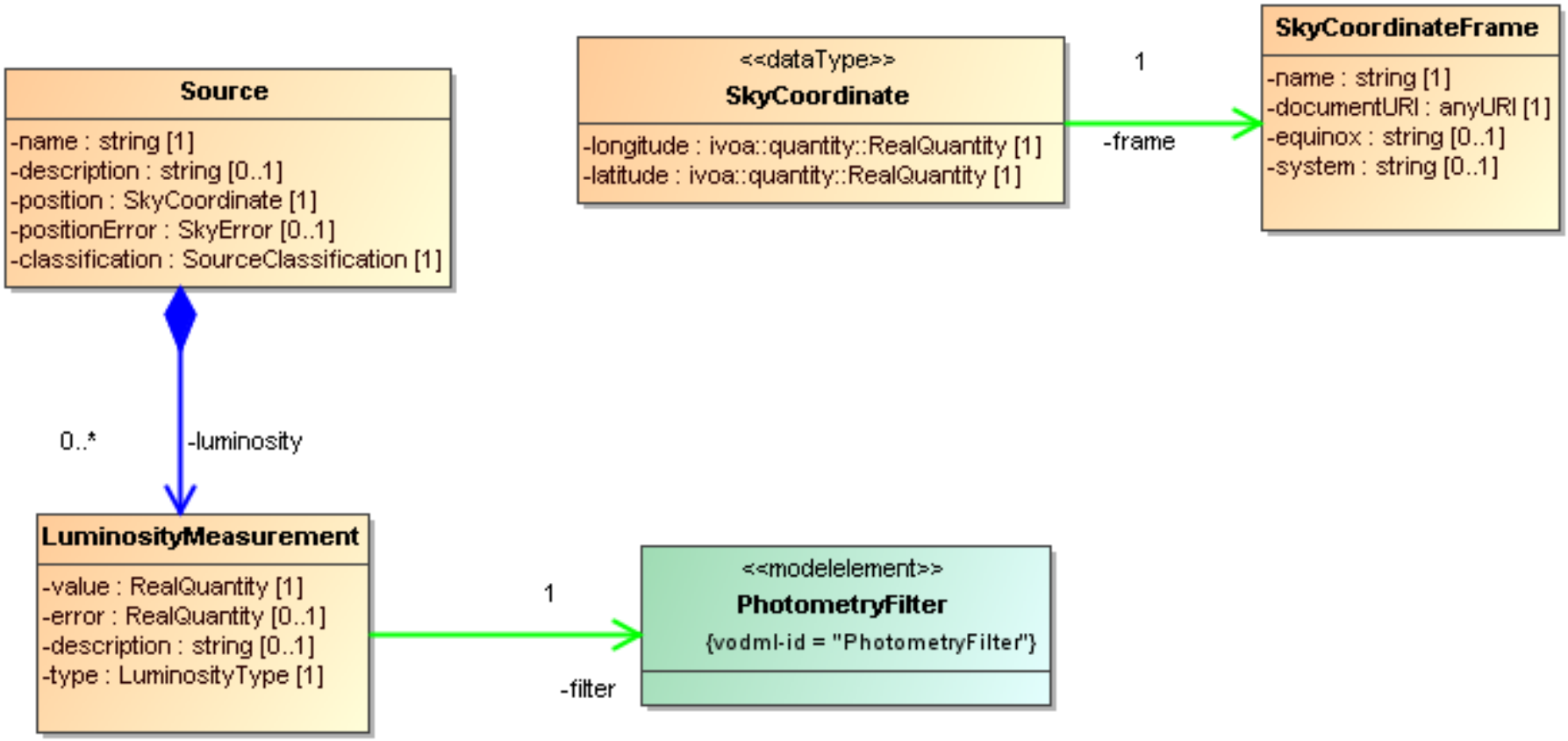
objid	ra	dec	u	g	r	i	z	run	rerun	camcol	field	specobjid	class	redshift	plate
1237680191504712292	319.42017295	-2.91605515	19.453272	17.512213	16.457823	15.911284	15.466995	8083	301	5	45	4933710530549838848	GALAXY	0.091911	4382
1237680191504842797	319.6726666	-2.89320328	18.006258	18.408295	17.027491	16.594183	15.47355	8083	301	5	47	4933700634945188864	STAR	-9.116632E-5	4382
1237660241388240997	51.95792979	0.44178806	17.90674	16.767498	16.243202	16.038309	15.933592	3438	301	5	146	2329593891403098112	STAR	-2.435169E-4	2069
1237660241388371981	52.15864799	0.5100779	18.619341	17.314531	16.763399	16.53455	16.394312	3438	301	5	148	2329602687496120320	STAR	-1.707261E-5	2069
1237660241925505040	52.72667419	0.88746662	17.930399	16.900446	16.418163	16.214106	16.1061	3438	301	6	152	2329600488472864768	STAR	-1.622409E-4	2069
1237660241925505156	52.85661769	0.97756273	18.178764	16.997499	16.512629	16.314194	16.207306	3438	301	6	152	2329599663839143936	STAR	-1.234436E-4	2069
1237662305111507089	202.55299093	39.86892911	17.820675	16.164869	15.296254	14.812856	14.419583	3919	301	1	16	5299625250001449984	GALAXY	0.048569	4707
1237663238739787997	52.05059022	0.14966321	19.351822	18.277271	18.06134	17.999191	17.999123	4136	301	4	165	2329595265792632832	STAR	-5.184785E-4	2069
1237651271358808122	158.78373508	63.9613952	19.283352	17.41073	16.419657	16.042131	15.731997	1350	301	1	295	550602195343534080	GALAXY	0.11802	489
1237651271358808125	158.82992158	63.94061555	19.297565	17.409573	16.431635	16.044048	15.707916	1350	301	1	295	550601370709813248	GALAXY	0.117888	489

hipparcos @vizier

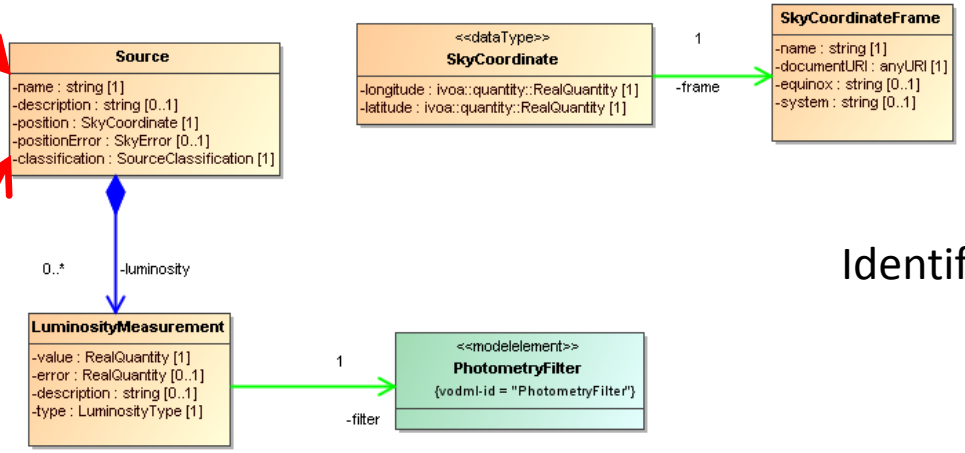
I/239/hip_main — The Hipparcos and Tycho Catalogues (ESA 1997)
1 annotation(s) - *post*
The Hipparcos Main Catalogue *(118218 rows)*

Full	RAJ2000 "h:m:s"	DEJ2000 "d:m:s"	HIP	RAhms	DEdms	Vmag mag	RA(ICRS) deg	DE(ICRS) deg	Plx mas	pmRA mas/yr	pmDE mas/yr	e_Plx mas	BTmag mag	e_ mag	VTmag mag	e_ mag	B-V mag	Hpmag mag	e_ mag
1	00 00 00.216	+01 05 20.43	1	00 00 00.22	+01 05 20.4	9.10	0.00091185	1.08901332	3.54	-5.20	-1.88	1.39	9.643	0.020	9.130	0.019	0.482	9.2043	0.0020
2	00 00 01.024	-19 29 55.82	2	00 00 00.91	-19 29 55.8	9.27	0.00379737	-19.49883745	21.90	181.21	-0.93	3.10	10.519	0.033	9.378	0.021	0.999	9.4017	0.0017
3	00 00 01.206	+38 51 33.40	3	00 00 01.20	+38 51 33.4	6.61	0.00500795	38.85928608	2.81	5.24	-2.91	0.63	6.576	0.004	6.621	0.005	-0.019	6.6081	0.0007
4	00 00 02.071	-51 53 36.76	4	00 00 02.01	-51 53 36.8	8.06	0.00838170	-51.89354612	7.75	62.85	0.16	0.97	8.471	0.007	8.092	0.007	0.370	8.1498	0.0011
5	00 00 02.394	-40 35 28.33	5	00 00 02.39	-40 35 28.4	8.55	0.00996534	-40.59122440	2.87	2.53	9.07	1.11	9.693	0.014	8.656	0.010	0.902	8.7077	0.0018
6	00 00 04.486	+03 56 47.25	6	00 00 04.35	+03 56 47.4	12.31	0.01814144	3.94648893	18.80	226.29	-12.84	4.99					1.336	12.4488	0.0085
7	00 00 05.283	+20 02 10.01	7	00 00 05.41	+20 02 11.8	9.64	0.02254891	20.03660216	17.74	-208.12	-200.79	1.30	10.542	0.039	9.679	0.030	0.740	9.6795	0.0021
8	00 00 06.562	+25 53 11.26	8	00 00 06.55	+25 53 11.3	9.05	0.02729160	25.88647445	5.17	19.09	-5.66	1.95	10.433	0.055	9.151	0.029	1.102	8.5522	0.1671
9	00 00 08.477	+36 35 09.45	9	00 00 08.48	+36 35 09.4	8.59	0.03534189	36.58593777	4.81	-6.30	8.42	0.99	9.962	0.025	8.711	0.015	1.067	8.7534	0.0018
10	00 00 08.740	-50 52 01.11	10	00 00 08.70	-50 52 01.5	8.59	0.03625309	-50.86707360	10.76	42.23	40.02	1.10	9.140	0.011	8.630	0.010	0.489	8.6994	0.0020
11	00 00 08.961	+46 56 23.99	11	00 00 08.95	+46 56 24.0	7.34	0.03729695	46.94000154	4.29	11.09	-2.02	0.84	7.446	0.005	7.364	0.005	0.081	7.3777	0.0010
12	00 00 09.816	-35 57 36.81	12	00 00 09.82	-35 57 36.8	8.43	0.04091756	-35.96022482	4.06	-5.99	-0.10	1.16	10.369	0.023	8.588	0.010	1.484	8.5598	0.0012
13	00 00 10.008	-22 35 40.94	13	00 00 10.00	-22 35 40.9	8.80	0.04167970	-22.59468060	3.49	8.45	-10.07	1.48	10.216	0.026	8.887	0.014	1.128	8.9707	0.0017

Simple Source model



objid	ra	dec	u	g	r	i	z	run	rerun	camcol	field	specobjid	class	redshift	plate	mjd
1237680191504712292	319.42017295	-2.91605515	19.453272	17.512213	16.457823	15.911284	15.466995	8083	301	5	45	4933710530549838848	GALAXY	0.091911	4382	5574
1237680191504842797	319.6726666	-2.89320328	18.006258	18.408295	17.027491	16.594183	15.47355	8083	301	5	47	4933700634945188864	STAR	-9.116632E-5	4382	5574
1237660241388240997	51.95792979	0.44178806	17.90674	16.767498	16.243202	16.038309	15.933592	3438	301	5	146	2329593891403098112	STAR	-2.435169E-4	2069	5337
1237660241388371981	52.15864799	0.5100779	18.619341	17.314531	16.763399	16.53455	16.394312	3438	301	5	148	2329602687496120320	STAR	-1.707261E-5	2069	5337
1237660241925505040	52.72667419	0.88746662	17.930399	16.900446	16.418163	16.214106	16.1061	3438	301	6	152	2329600488472864768	STAR	-1.622409E-4	2069	5337
1237660241925505156	52.85661769	0.97756273	18.178764	16.997499	16.512629	16.314194	16.207306	3438	301	6	152	2329599663839143936	STAR	-1.234436E-4	2069	5337
1237662305111507089	202.55299093	39.86892911	17.820675	16.164869	15.296254	14.812856	14.419583	3919	301	1	16	5299625250001449984	GALAXY	0.048569	4707	5565
1237663238739787997	52.05059022	0.14966321	19.351822	18.277271	18.06134	17.999191	17.999123	4136	301	4	165	2329595265792632832	STAR	-5.184785E-4	2069	5337
1237651271358808122	158.78373508	63.9613952	19.283352	17.41073	16.419657	16.042131	15.731997	1350	301	1	295	550602195343534080	GALAXY	0.11802	489	5193
1237651271358808125	158.82992158	63.94061555	19.297565	17.409573	16.431635	16.044048	15.707916	1350	301	1	295	550601370709813248	GALAXY	0.117888	489	5193

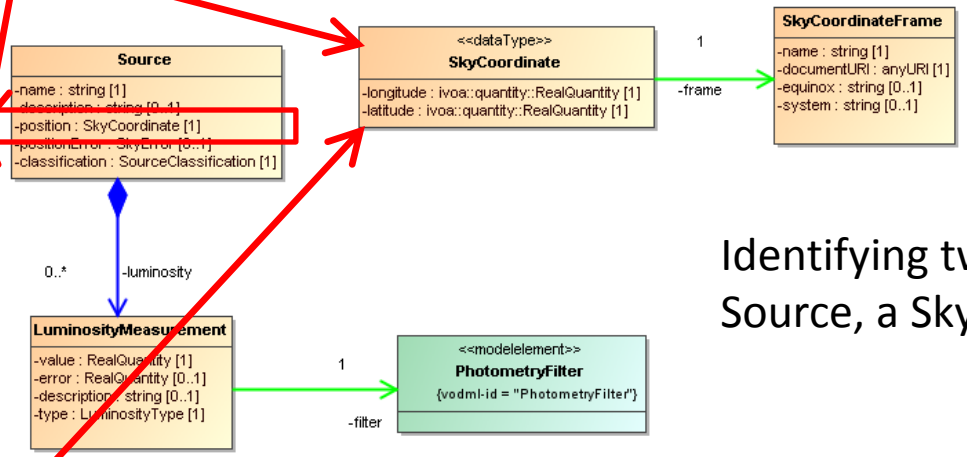


Identifying a row as a Source

I/239/hip_main — The Hipparcos and Tycho Catalogues (ESA 1997)
(annotation(s) - post — The Hipparcos Main Catalogue *(118218 rows)*

Full	RAJ2000 "h:m:s"	DEJ2000 "d:m:s"	HIP	RAhms	DEdms	Vmag mag	RA(ICRS) deg	DE(ICRS) deg	Plx mas	pmRA mas/yr	pmDE mas/yr	e_Plx mas	BTmag mag	e_ mag	VTmag mag	e_ mag	B-V mag	Hpmag mag	e_ mag
1	00 00 00.216	+01 05 20.43	1	00 00 00.22	+01 05 20.4	9.10	0.00091185	1.08901332	3.54	-5.20	-1.88	1.39	9.643	0.020	9.130	0.019	0.482	9.2043	0.0020
2	00 00 01.024	-19 29 55.82	2	00 00 00.91	-19 29 55.8	9.27	0.00379737	-19.49883745	21.00	181.21	0.93	3.10	10.519	0.033	9.378	0.021	0.999	9.4017	0.0017
3	00 00 01.206	+38 51 33.40	3	00 00 01.20	+38 51 33.4	6.61	0.00500795	38.85928608	2.81	5.24	-2.91	0.63	6.576	0.004	6.621	0.005	-0.019	6.6081	0.0007
4	00 00 02.071	-51 53 36.76	4	00 00 02.01	-51 53 36.8	8.06	0.00838170	-51.89354612	7.75	62.85	0.16	0.97	8.471	0.007	8.092	0.007	0.370	8.1498	0.0011
5	00 00 02.394	-40 35 28.33	5	00 00 02.39	-40 35 28.4	8.55	0.00996534	-40.59122440	2.87	2.53	9.07	1.11	9.693	0.014	8.656	0.010	0.902	8.7077	0.0018
6	00 00 04.486	+03 56 47.25	6	00 00 04.35	+03 56 47.4	12.31	0.01814144	3.94648893	18.80	226.29	-12.84	4.99					1.336	12.4488	0.0085
7	00 00 05.283	+20 02 10.01	7	00 00 05.41	+20 02 11.8	9.64	0.02254891	20.03660216	17.74	-208.12	-200.79	1.30	10.542	0.039	9.679	0.030	0.740	9.6795	0.0021
8	00 00 06.562	+25 53 11.26	8	00 00 06.55	+25 53 11.3	9.05	0.02729160	25.88647445	5.17	19.09	-5.66	1.95	10.433	0.055	9.151	0.029	1.102	8.5522	0.1671
9	00 00 08.477	+36 35 09.45	9	00 00 08.48	+36 35 09.4	8.59	0.03534189	36.58593777	4.81	-6.30	8.42	0.99	9.962	0.025	8.711	0.015	1.067	8.7534	0.0018
10	00 00 08.740	-50 52 01.11	10	00 00 08.70	-50 52 01.5	8.59	0.03625309	-50.86707360	10.76	42.23	40.02	1.10	9.140	0.011	8.630	0.010	0.489	8.6994	0.0020
11	00 00 08.961	+46 56 23.99	11	00 00 08.95	+46 56 24.0	7.34	0.03729695	46.94000154	4.29	11.09	-2.02	0.84	7.446	0.005	7.364	0.005	0.081	7.3777	0.0010
12	00 00 09.816	-35 57 36.81	12	00 00 09.82	-35 57 36.8	8.43	0.04091756	-35.96022482	4.06	-5.99	-0.10	1.16	10.369	0.023	8.588	0.010	1.484	8.5598	0.0012
13	00 00 10.008	-22 35 40.94	13	00 00 10.00	-22 35 40.9	8.80	0.04167970	-22.59468060	3.49	8.45	-10.07	1.48	10.216	0.026	8.887	0.014	1.128	8.9707	0.0017

objid	ra	dec	u	g	r	i	z	run	rerun	camcol	field	specobjid	class	redshift	plate	mjd
1237680191504712292	319.42017295	-2.91605515	19.453272	17.512213	16.457823	15.911284	15.466995	8083	301	5	45	4933710530549838848	GALAXY	0.091911	4382	5574
1237680191504842797	319.6726666	-2.89320328	18.006258	18.408295	17.027491	16.594183	15.47355	8083	301	5	47	4933700634945188864	STAR	-9.116632E-5	4382	5574
1237660241388240997	51.95792979	0.44178806	17.90674	16.767498	16.243202	16.038309	15.933592	3438	301	5	146	2329593891403098112	STAR	-2.435169E-4	2069	5337
1237660241388371981	52.15864799	0.5100779	18.619341	17.314531	16.763399	16.53455	16.394312	3438	301	5	148	2329602687496120320	STAR	-1.707261E-5	2069	5337
1237660241925505040	52.72667419	0.88746662	17.930399	16.900446	16.418163	16.214106	16.1061	3438	301	6	152	2329600488472864768	STAR	-1.622409E-4	2069	5337
1237660241925505156	52.85661769	0.97756273	18.178764	16.997499	16.512629	16.314194	16.207306	3438	301	6	152	2329599663839143936	STAR	-1.234436E-4	2069	5337
1237662305111507089	202.55299093	39.86892911	17.820675	16.164869	15.296254	14.812856	14.419583	3919	301	1	16	5299625250001449984	GALAXY	0.048569	4707	5565
1237663238739787997	52.05059022	0.14966321	19.351822	18.277271	18.06134	17.999191	17.999123	4136	301	4	165	2329595265792632832	STAR	-5.184785E-4	2069	5337
1237651271358808122	158.78373508	63.9613952	19.283352	17.41073	16.419657	16.042131	15.731997	1350	301	1	295	550602195343534080	GALAXY	0.11802	489	5193
1237651271358808125	158.82992158	63.94061555	19.297565	17.409573	16.431635	16.044048	15.707916	1350	301	1	295	550601370709813248	GALAXY	0.117888	489	5193



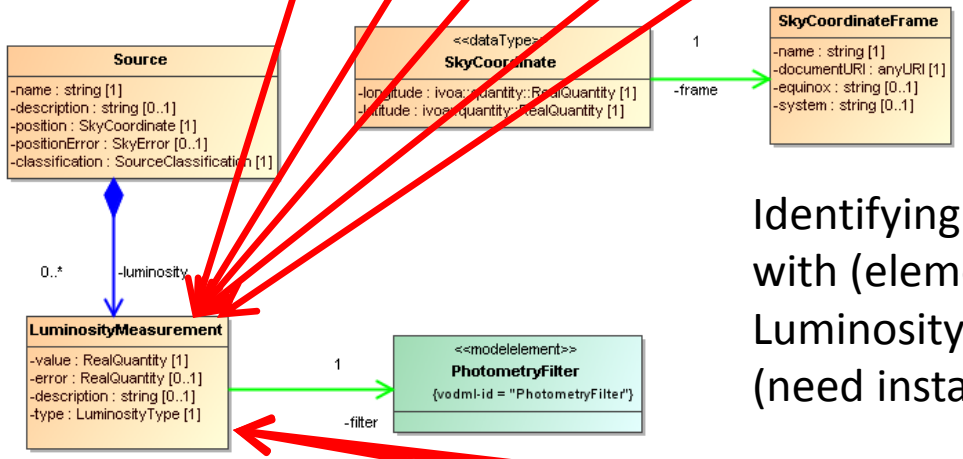
Identifying two columns as the Position of a Source, a SkyCoordinate

I/239/hip_main
1 annotation(s) - post

The Hipparcos and Tycho Catalogues (ESA 1997)
The Hipparcos Main Catalogue *(118218 rows)*

Full	RAJ2000 "h:m:s"	DEJ2000 "d:m:s"	HIP	RAhms	DEdms	Vmag mag	RA(ICRS) deg	DE(ICRS) deg	Plx mas	pmRA mas/yr	pmDE mas/yr	e_Plx mas	BTmag mag	e_ mag	VTmag mag	e_ mag	B-V mag	Hpmag mag	e_ mag
1	00 00 00.216	+01 05 20.43	1	00 00 00.22	+01 05 20.4	9.10	0.00091185	1.08901332	3.54	-5.20	-1.88	1.39	9.643	0.020	9.130	0.019	0.482	9.2043	0.0020
2	00 00 01.024	-19 29 55.82	2	00 00 00.91	-19 29 55.8	9.27	0.00379737	-19.49883745	21.90	181.21	-0.93	3.10	10.519	0.033	9.378	0.021	0.999	9.4017	0.0017
3	00 00 01.206	+38 51 33.40	3	00 00 01.20	+38 51 33.4	6.61	0.00500795	38.85928608	2.81	5.24	-2.91	0.63	6.576	0.004	6.621	0.005	-0.019	6.6081	0.0007
4	00 00 02.071	-51 53 36.76	4	00 00 02.01	-51 53 36.8	8.06	0.00838170	-51.89354612	7.75	62.85	0.16	0.97	8.471	0.007	8.092	0.007	0.370	8.1498	0.0011
5	00 00 02.394	-40 35 28.33	5	00 00 02.39	-40 35 28.4	8.55	0.00996534	-40.59122440	2.87	2.53	9.07	1.11	9.693	0.014	8.656	0.010	0.902	8.7077	0.0018
6	00 00 04.486	+03 56 47.25	6	00 00 04.35	+03 56 47.4	12.31	0.01814144	3.94648893	18.80	226.29	-12.84	4.99					1.336	12.4488	0.0085
7	00 00 05.283	+20 02 10.01	7	00 00 05.41	+20 02 11.8	9.64	0.02254891	20.03660216	17.74	-208.12	-200.79	1.30	10.542	0.039	9.679	0.030	0.740	9.6795	0.0021
8	00 00 06.562	+25 53 11.26	8	00 00 06.55	+25 53 11.3	9.05	0.02729160	25.88647445	5.17	19.09	-5.66	1.95	10.433	0.055	9.151	0.029	1.102	8.5522	0.1671
9	00 00 08.477	+36 35 09.45	9	00 00 08.48	+36 35 09.4	8.59	0.03534189	36.58593777	4.81	-6.30	8.42	0.99	9.962	0.025	8.711	0.015	1.067	8.7534	0.0018
10	00 00 08.740	-50 52 01.11	10	00 00 08.70	-50 52 01.5	8.59	0.03625309	-50.86707360	10.76	42.23	40.02	1.10	9.140	0.011	8.630	0.010	0.489	8.6994	0.0020
11	00 00 08.961	+46 56 23.99	11	00 00 08.95	+46 56 24.0	7.34	0.03729695	46.94000154	4.29	11.09	-2.02	0.84	7.446	0.005	7.364	0.005	0.081	7.3777	0.0010
12	00 00 09.816	-35 57 36.81	12	00 00 09.82	-35 57 36.8	8.43	0.04091756	-35.96022482	4.06	-5.99	-0.10	1.16	10.369	0.023	8.588	0.010	1.484	8.5598	0.0012
13	00 00 10.008	-22 35 40.94	13	00 00 10.00	-22 35 40.9	8.80	0.04167970	-22.59468060	3.49	8.45	-10.07	1.48	10.216	0.026	8.887	0.014	1.128	8.9707	0.0017

objid	ra	dec	u	g	r	i	z	run	rerun	camcol	field	specobjid	class	redshift	plate	mjd
1237680191504712292	319.42017295	-2.91605515	19.453272	17.512213	16.457823	15.911284	15.466995	8083	301	5	45	4933710530549838848	GALAXY	0.091911	4382	5574
1237680191504842797	319.6726666	-2.89320328	18.006258	18.408295	17.027491	16.594183	15.47355	8083	301	5	47	4933700634945188864	STAR	-9.116632E-5	4382	5574
1237660241388240997	51.95792979	0.44178806	17.90674	16.767498	16.243202	16.038309	15.933592	3438	301	5	146	2329593891403098112	STAR	-2.435169E-4	2069	5337
1237660241388371981	52.15864799	0.5100779	18.619341	17.314531	16.763399	16.53455	16.394312	3438	301	5	148	2329602687496120320	STAR	-1.707261E-5	2069	5337
1237660241925505040	52.72667419	0.88746662	17.930399	16.900446	16.418163	16.214106	16.1061	3438	301	6	152	2329600488472864768	STAR	-1.622409E-4	2069	5337
1237660241925505156	52.85661769	0.97756273	18.178764	16.997499	16.512629	16.314194	16.207306	3438	301	6	152	2329599663839143936	STAR	-1.234436E-4	2069	5337
1237662305111507089	202.55299093	39.86892911	17.820675	16.164869	15.296254	14.812856	14.419583	3919	301	1	16	5299625250001449984	GALAXY	0.048569	4707	5565
1237663238739787997	52.05059022	0.14966321	19.351822	18.277271	18.06134	17.999191	17.999123	4136	301	4	165	2329595265792632832	STAR	-5.184785E-4	2069	5337
1237651271358808122	158.78373508	63.9613952	19.283352	17.41073	16.419657	16.042131	15.731997	1350	301	1	295	550602195343534080	GALAXY	0.11802	489	5193
1237651271358808125	158.82992158	63.94061555	19.297565	17.409573	16.431635	16.044048	15.707916	1350	301	1	295	550601370709813248	GALAXY	0.117888	489	5193



Identifying magnitude+error columns with (elements in) the collection of LuminosityMeasurement-s of a Source. (need instance of PhotometryFilter!)

I/239/hip_main
1 annotation(s) - *post*

The Hipparcos and Tycho Catalogues (ESA 1997)
The Hipparcos Main Catalogue *(118218 rows)*

Full	RAJ2000 "h:m:s"	DEJ2000 "d:m:s"	HIP	RAhms	DEdms	Vmag mag	RA(ICRS) deg	DE(ICRS) deg	Plx mas	pmRA mas/yr	pmDE mas/yr	e_Plx mas	BTmag mag	e_ mag	VTmag mag	e_ mag	B-V mag	Hpmag mag	e_ mag
1	00 00 00.216	+01 05 20.43	1	00 00 00.22	+01 05 20.4	9.10	0.00091185	1.08901332	3.54	-5.20	-1.88	1.39	9.643	0.020	9.130	0.019	0.482	9.2043	0.0020
2	00 00 01.024	-19 29 55.82	2	00 00 00.91	-19 29 55.8	9.27	0.00379737	-19.49883745	21.90	181.21	-0.93	3.10	10.519	0.033	9.378	0.021	0.999	9.4017	0.0017
3	00 00 01.206	+38 51 33.40	3	00 00 01.20	+38 51 33.4	6.61	0.00500795	38.85928608	2.81	5.24	-2.91	0.63	6.576	0.004	6.621	0.005	-0.019	6.6081	0.0007
4	00 00 02.071	-51 53 36.76	4	00 00 02.01	-51 53 36.8	8.06	0.00838170	-51.89354612	7.75	62.85	0.16	0.97	8.471	0.007	8.092	0.007	0.370	8.1498	0.0011
5	00 00 02.394	-40 35 28.33	5	00 00 02.39	-40 35 28.4	8.55	0.00996534	-40.59122440	2.87	2.53	9.07	1.11	9.693	0.014	8.656	0.010	0.902	8.7077	0.0018
6	00 00 04.486	+03 56 47.25	6	00 00 04.35	+03 56 47.4	12.31	0.01814144	3.94648893	18.80	226.29	-12.84	4.99					1.336	12.4488	0.0085
7	00 00 05.283	+20 02 10.01	7	00 00 05.41	+20 02 11.8	9.64	0.02254891	20.03660216	17.74	-208.12	-200.79	1.30	10.542	0.039	9.679	0.030	0.740	9.6795	0.0021
8	00 00 06.562	+25 53 11.26	8	00 00 06.55	+25 53 11.3	9.05	0.02729160	25.88647445	5.17	19.09	-5.66	1.95	10.433	0.055	9.151	0.029	1.102	8.5522	0.1671
9	00 00 08.477	+36 35 09.45	9	00 00 08.48	+36 35 09.4	8.59	0.03534189	36.58593777	4.81	-6.30	8.42	0.99	9.962	0.025	8.711	0.015	1.067	8.7534	0.0018
10	00 00 08.740	-50 52 01.11	10	00 00 08.70	-50 52 01.5	8.59	0.03625309	-50.86707360	10.76	42.23	40.02	1.10	9.140	0.011	8.630	0.010	0.489	8.6994	0.0020
11	00 00 08.961	+46 56 23.99	11	00 00 08.95	+46 56 24.0	7.34	0.03729695	46.94000154	4.29	11.09	-2.02	0.84	7.446	0.005	7.364	0.005	0.081	7.3777	0.0010
12	00 00 09.816	-35 57 36.81	12	00 00 09.82	-35 57 36.8	8.43	0.04091756	-35.96022482	4.06	-5.99	-0.10	1.16	10.369	0.023	8.588	0.010	1.484	8.5598	0.0012
13	00 00 10.008	-22 35 40.94	13	00 00 10.00	-22 35 40.9	8.80	0.04167970	-22.59468060	3.49	8.45	-10.07	1.48	10.216	0.026	8.887	0.014	1.128	8.9707	0.0017

All this and more is formalized in the UTYPE-mapping proposal.

See Omar’s talk

Why VO-DML?

Problem

- Utypes are pointers into a data model
  - need something to point at !
- Something that is
  - machine-readable
  - independent of the precise data model
  - rich enough to represent every aspect of data model
- Most DMs in IVOA do not have such a representation
  - generally a (word, pdf) document with UML-like diagrams
  - most formal representation generally an XML schema, designed differently, not necessarily representative of model
  - sometimes a table design (ObsTAP+ObsCore)
  - Generally a list of utypes , a (very) lossy representation of full DM

Threat of new Babylonian confusion

DaM	Photometry DM	1.0	RFC	1.0 1.0 1.0 1.0 1.0
	Simulation Data Model	1.0		1.0 1.0 1.0 1.0 1.0 1.0
	Space-Time Coordinate Metadata for the Virtual Observatory (STC)	1.33		1.33 1.31 1.30 1.21 1.20 1.10 1.00
	Data Model for Astronomical DataSet Characterisation	1.13		1.13 1.12 1.12 1.11 1.10 1.00
	Simple Spectral Lines Data Model	1.0		1.0 1.0 1.0 1.0 1.0
	IVOA Spectrum Data Model	1.1		1.1 1.1 1.1 1.03 1.02 1.01 1.01 1.01 1.00
	IVOA Spectral Data Model	2.0		2.0 2.0 2.0
	Observation Data Model Core Components and its Implementation in the Table Access Protocol	1.0		1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0
	Characterisation DM: Complements and new features. Observation quality and variability - complex datasets		1.0	1.0
ReR	IVOA Identifiers	1.12		1.12 1.11 1.10 1.10 1.10 1.00
	IVOA Registry Interfaces	1.0		1.0 1.0 1.00 1.02 1.01 1.00
	Resource Metadata for the Virtual Observatory	1.12		1.12 1.12 1.10 1.10 1.01 1.01 1.00 1.00
	StandardsRegExt: a VOResource Schema Extension for Describing IVOA Standards	1.0		1.0 1.0 1.0 1.0 1.0 1.0 1.0
	SimpleDALRegExt: Describing Simple Data Access Services	1.0	RFC	1.0 1.0 1.0
	VOResource: an XML Encoding Schema for Resource Metadata	1.03		1.03 1.02 1.02 1.01 1.00
	VODataService: a VOResource Schema Extension for Describing Collections and Services	1.1		1.1 1.1 1.1 1.1 1.1 1.10
	IVOA Registry Relational Schema	1.0		1.0

Propose:
Common data modeling language

- Conceptual: **VO-DML**
  - simple subset of UML *Class Diagram* elements
- UML Profile: **VO-UML**
  - informative, “whiteboard language”
- Serialization format: **VO-DML/Schema**
  - XML schema + Schematron rules
  - MOF level 2 language
  - Similar to UML/XMI, RDF/RDF Schema, EMF/eCore, Odata/CSDL
- Serializations : **VO-DML/XML**
  - machine readable representation of actual models
  - contain the targets of utype-s

- See VO-DML WD-draft (in progress) for details

Other advantages

- Formalizes reuse of existing Models and their contents
- Standardize serialization through meta-model mapping
  - to Java ✓
  - to HTML ✓
  - to VOTable via utypes ✓
  - to XSD and RDB ✓ (proof of concept in VO-URP)
  - to Python (soon)
  - …
- Formal, rigorous definition
  - makes models more robust and easier to reuse
  - helps discover weaknesses
  - facilitates creation of prototype implementations and documentation through generation pipelines

Anything missing?

Expressing data models in VO-DML

(see DM session this afternoon)