

Simple(?) Time Series in VizieR

IVOA Interoperability meeting
Shanghai, May 18

Sébastien Derriere



- 16,000 catalogues
 - 1750+ with timeSeries flag
 - More than 1 in 10 for recent cats +1400 cats, +250 timeSeries



Find catalogs among 15978 available

Expand search

? **Catalog**, author's name, word(s) from title, description, etc.
e.g.: AGN, Veron, I/239, or bibcodes...

▶ **Search for catalogs by column descriptions (UCD)** ?

▼ **Hide catalogs containing additional data**

time serie spectrum images cube SED (Spectral Energy Distribution) none

Wavelength Mission Astronomy

Radio	AKARI	Abundances
IR	ANS	Ages
optical	ASCA	AGN
UV	BeppoSAX	Associations
EUV	CGRO	Atomic_Data
X-ray	Chandra	Binaries:cataclysmic
Gamma-ray	COBE	Binaries:eclipsing

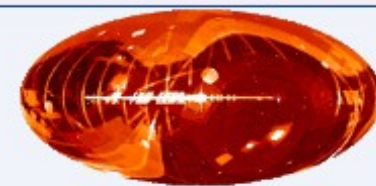
Search by Position across 17071 tables

Target Name (resolved by [Sesame](#)) or Position:

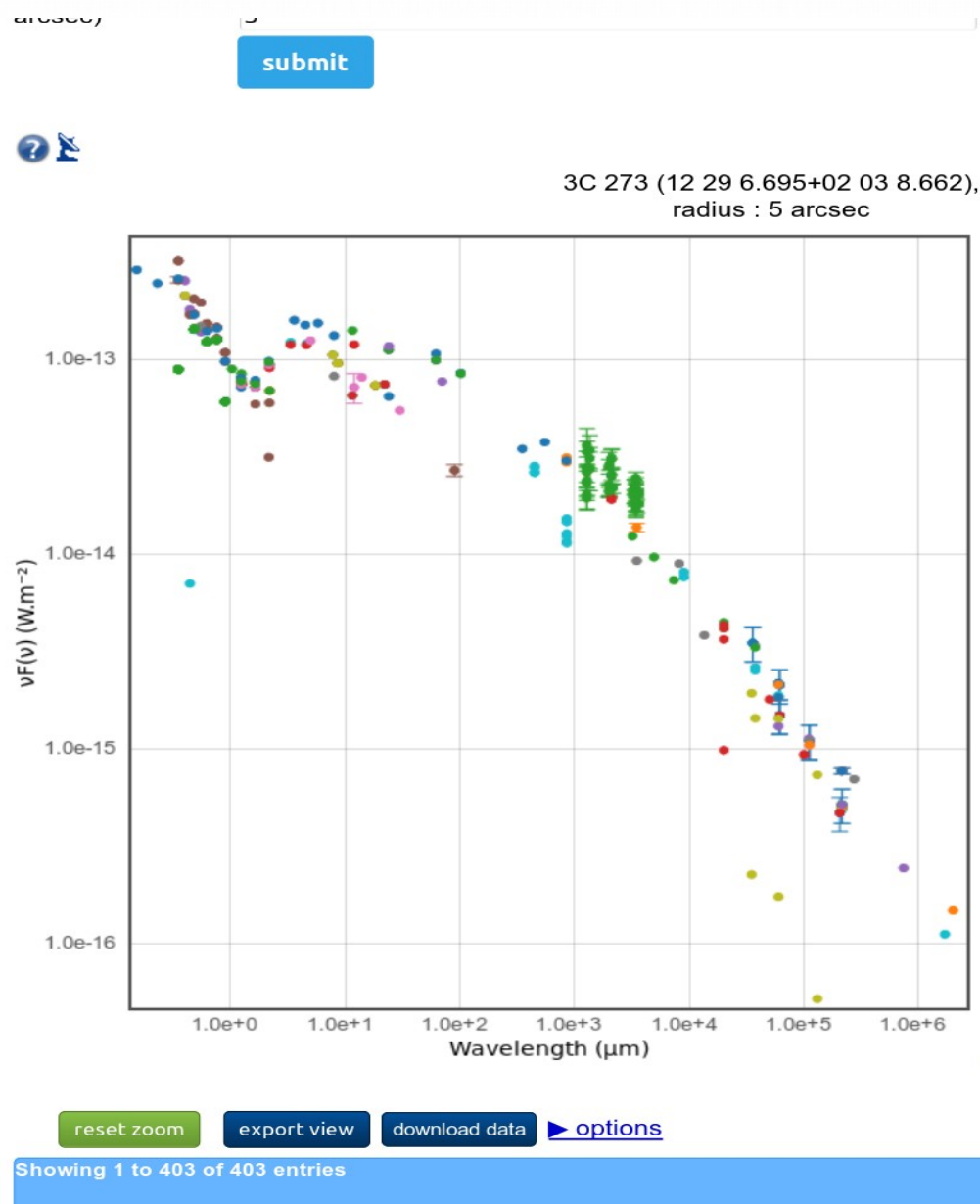
J2000

Target dimension:

Radius Box size



VizieR photometry viewer



Extract photometry points from many catalogues

- Huge characterization work for each catalogue : filters, photometric systems, measurements (flux, mag)
- Simple VOTable output
- Provided « as is » : not an SED (different spatial resolutions) ; might not be complete, but saves a lot of time

□ The dream : simple time series

- Could we explore VizieR contents and retrieve time series in an easy way ?
- VERY difficult :
 - Heterogeneous formats
 - Different quantities : time, phase, mag, color, velocity
 - Target identification difficult
 - Database-ready, bulk of FITS files, non standard ASCII files with mixed contents...
 - Missing characterization / metadata, or only in human-readable form
 - Time coverage, sampling

□ What kind of catalogues ?

- **Big missions**
 - HIPPARCOS & Tycho light curves
 - Kepler (external link)
 - **CoRoT**
 - OGLE, MACHO, EROS
- **Variability surveys**
- **Tables dedicated to (few) individual object**
- **Solar data**
- ...

□ What kind of time series ?

- **Light curves** ~70 %
- Radial velocities ~23 %
- Eclipse, transit ~9 %
- Polarization, Stokes parameters ~1 %
- Solar data ~1 %
- Other ~5 %
 - Line index, line width, temperature, abundance, magnetic field, ...

Rough
estimates
based on
~200 cats

□ Simple(?) requirement

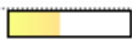
- I am studying a specific target

Give me all the time-series information from VizieR for this target !

For more complete science use cases, see <http://wiki.ivoa.net/twiki/bin/view/IVOA/CSPTIMEseries>

Example 1 : J/ApJ/715/1203/table3

J/ApJ/715/1203

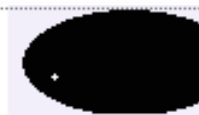


(c) ν Andromedae system with HST (McArthur+, 2010)

[ReadMe+ftp](#)

[timeSerie](#)

[2010ApJ...715.1203M](#)



[J/ApJ/715/1203/table3](#)

ν Andromedae system with HST (McArthur+, 2010)

[ReadMe+ftp](#)

[Post annotation](#)

HET relative radial velocities for ν And

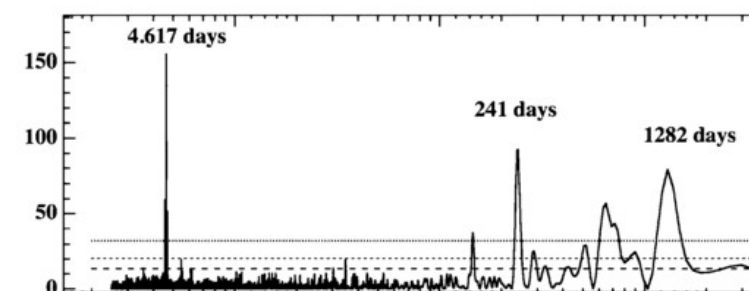
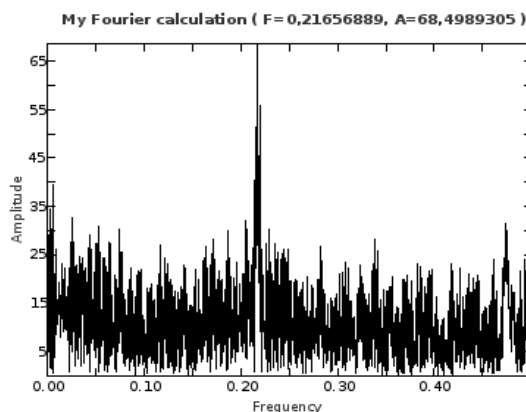
[timeSerie](#)

[2010ApJ...715.1203M](#)

([Velocity curve](#)) (79 rows)

Full	JD d	RV m/s	e m/s
1	2453220.855083	88.18	8.42
2	2453221.851560	59.52	5.30
3	2453222.857669	139.98	4.78
4	2453227.838449	156.34	6.61
5	2453237.839341	181.21	7.44
6	2453240.843498	67.25	4.86
7	2453255.800928	146.32	5.13
8	2453257.762190	46.36	4.49
9	2453261.755993	104.59	4.18
10	2453263.778727	25.67	5.24
11	2453265.771444	149.36	5.73
12	2453286.698745	35.97	4.49
13	2453288.669645	171.86	4.78
14	2453293.678115	156.09	4.66
15	2453295.673163	42.51	5.21
16	2453297.657779	188.59	4.81
17	2453299.894592	47.12	7.00

- Table = one target only
- JD vs RV (no coordinates)
- Easily exported to VOTable, SAMP...



Example 2 : CoRoT



CoRoT observation log (N2-4.4) (CoRoT 2016)

[ReadMe+ftp](#)

[SgGda/fits](#)



B/corot

[timeSerie](#)

[timeSerie/fits](#)

[Similar Catalogs](#)

[2014yCat...102028C](#)

[Post annotation](#)

1.B/corot/Faint_starStars observed in the faint star mode with E(B-V) (177382 rows)

3	06 43 48.03	-00 51 43.1		1	2007-02-03	2007-04-02	102707647	K4III	0.50	IRa01	12.761	100.95011	-00.86196			1.158	TS_W
4	06 43 36.39	-00 47 34.7		1	2007-02-03	2007-04-02	102698090	B0V	0.70	IRa01	14.060	100.90163	-00.79296			1.158	TS_W
5	06 43 48.36	-00 58 07.3		1	2007-02-03	2007-04-02	102707895	A0V	0.45	IRa01	13.810	100.95152	-00.96869			1.158	TS_W
6	06 43 38.81	-00 42 22.5		1	2007-02-03	2007-04-02	102700060	A0V	0.25	IRa01	13.742	100.91170	-00.70624			1.158	TS_W
7	06 43 48.51	-00 53 27.0		1	2007-02-03	2007-04-02	102708010	F5IV	0.20	IRa01	14.838	100.95213	-00.89082			1.158	TS_W
8	06 43 38.99	-00 49 47.2		1	2007-02-03	2007-04-02	102700196	A5V	0.25	IRa01	14.064	100.91244	-00.82979			1.158	TS_W
9	06 43 48.61	-00 45 35.6		1	2007-02-03	2007-04-02	102708083	M0III	0.65	IRa01	12.315	100.95254	-00.75988			1.158	TS_W
0	06 43 40.20	-00 39 37.9		1	2007-02-03	2007-04-02	102701287	K0III	0.40	IRa01	14.017	100.91749	-00.66052			1.158	TS_W

- 1 catalogue row per target
- Thumbnails
- Link to FITS file

Example 3 : catalogue of 8 RR Lyrae

Abundances of 8 RR Lyrae subclass C variable stars (Govea+, 2014) [ReadMe+ftp](#)

J/ApJ/782/59

[timeSerie](#)

[Similar Catalogs](#)

[2014ApJ...782...59G](#)

[Post annotation](#)

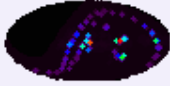


1.J/ApJ/782/59/table2 Spectroscopic data (147 rows)

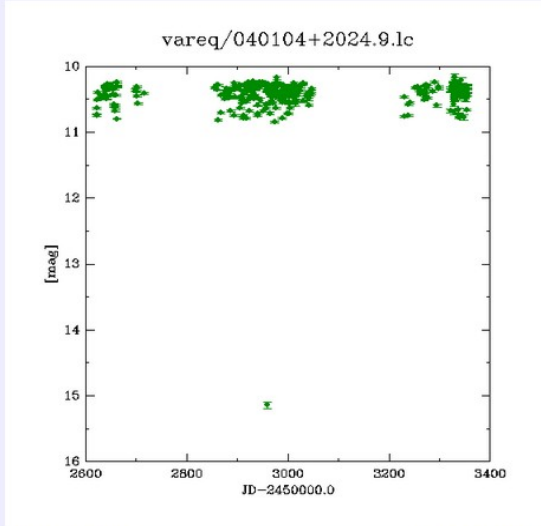
<u>Full</u>	<u>Star</u>	<u>f_</u>	<u>HJD</u> <u>d</u>	<u>Phase</u>	<u>RV</u> <u>km/s</u>	<u><Phase></u>	<u><RV></u> <u>km/s</u>	<u>Bin</u>	<u>S/N1</u>	<u>S/N2</u>
<u>1</u>	AS081933		5324.4711	0.369	273.76	0.38	280.5	2	61	132
<u>2</u>	AS081933		5324.4756	0.385	272.01					
<u>3</u>	AS081933		4904.5545	0.418	279.93	0.43	282.3	2	83	167
<u>4</u>	AS081933		4904.5630	0.448	281.00					
<u>5</u>	AS081933		4905.5488	0.899	281.67	0.91	272.9	2	94	167
<u>6</u>	AS081933		4905.5553	0.922	282.79					
<u>7</u>	AS085254		4905.5656	0.354	236.42	0.38	236.7	2	29	89
<u>8</u>	AS085254		4905.5768	0.396	236.92					
<u>9</u>	AS085254		4904.5734	0.636	239.65	0.66	240.2	2	26	71
<u>10</u>	AS085254		4904.5832	0.673	240.67					
<u>11</u>	AS085254		5324.4849	0.915	240.65	0.94	239.2	2	30	77
<u>12</u>	AS085254		5324.4954	0.954	237.79					
<u>13</u>	AS090900		4903.5352	0.427	349.01	0.44	349.3	2	41	93
<u>14</u>	AS090900		4903.5404	0.444	349.50					
<u>15</u>	AS090900		4903.5783	0.569	352.52	0.59	356.0	4	39	132
<u>16</u>	AS090900		5324.5096	0.584	357.91					
<u>17</u>	AS090900		4903.5834	0.585	354.05					
<u>18</u>	AS090900		5324.5155	0.603	359.58					
<u>19</u>	AS090900		4903.6805	0.905	365.59	0.91	365.3	2	29	76
<u>20</u>	AS090900		4903.6856	0.922	364.94					
<u>21</u>	AS110522	a	5021.5146	0.090	218.88					
<u>22</u>	AS110522	a	5021.5229	0.118	219.91					
<u>23</u>	AS110522		4906.6954	0.225	222.25	0.24	222.9	2	31	85
<u>24</u>	AS110522		4906.7042	0.255	223.61					
<u>25</u>	AS110522		5022.4659	0.320	230.00	0.33	230.2	2	31	82
<u>26</u>	AS110522		5022.4659	0.346	230.30					

- 8 targets in same table (truncated identifiers!)
- No coordinates
- JD-Offset & Phase ($T_0 +$ Period)

Example 4 : II/264

ASAS Variable Stars in Southern hemisphere (Pojmanski+, 2002-2005) [ReadMe+ftp](#)
 II/264 [timeSerie](#) [Similar Catalogs](#) [2002AcA...52..397P](#) 
[Post annotation](#)
 1.II/264/var V-band light curves (49650 rows)

Full	<u>r</u> deg	<u>RAJ2000</u> "h:m:s"	<u>DEJ2000</u> "d:m:s"	<u>ASAS</u>	<u>RAJ2000</u> deg	<u>DEJ2000</u> deg	<u>Mag</u> mag	<u>e_</u> mag	<u>o_</u>	<u>LCname</u>
1	0.002410	04 01 02.87	+20 24 43.3	040103+2024.7	060.26196	+20.41202			336	vareq/040104+2024.9.lc
2	0.495148	04 02 41.38	+20 43 40.6	040241+2043.7	060.67242	+20.72795			182	vareq/040242+2043.7.lc
3	0.707861	04 02 59.45	+19 52 16.9	040259+1952.3	060.74769	+19.87136			214	vareq/040300+1952.3.lc
4	0.752594	04 02 39.26	+21 04 01.0	040239+2104.0	060.66358	+21.06695			179	vareq/040239+2103.9.lc
5	0.753728	04 02 46.12	+21 03 08.0	040246+2103.1	060.69216	+21.05222			176	vareq/040246+2103.2.lc
6	0.865000	03 57 23.97	+20 32 20.8	035724+2032.3	059.34985	+20.53910			217	vareq/035724+2032.3.lc
7	1.110211	04 01 17.08	+19 12 00.1	040118+1912.0	061.07490	+19.21678			114	vareq/040418+1913.0.lc
8					62.05411	+19.94458			169	vareq/040813+1956.7.lc
9					58.25671	+20.20756			208	vareq/035302+2012.5.lc



```
#-- vareq/040104+2024.9.lc
#JD-2450000.0 [mag] (error)

# m = -1, S = 16
2621.6293 10.747 0.015
2629.6167 10.458 0.015
2635.5965 10.441 0.013
2639.6138 10.362 0.015
2641.6211 10.451 0.014
2643.6327 10.328 0.013
2645.6006 10.317 0.013
2654.5550 10.418 0.013
2657.5951 10.340 0.014
2659.6084 10.310 0.013
2661.6053 10.797 0.011
2699.5102 10.347 0.015
2701.5158 10.383 0.016
2854.9217 10.326 0.012
2859.8803 10.284 0.013
2862.8914 10.286 0.014
2867.8977 10.433 0.014
2875.9137 10.489 0.013
2883.8966 10.452 0.013
```

- Coordinates and target
- Link to plot + ascii file, missing metadata

Postscript Figure [Data as a Table](#)

Adapt Plot x cuts: xlog Bitmap size: y cuts: ylog [Adapt the plot](#)

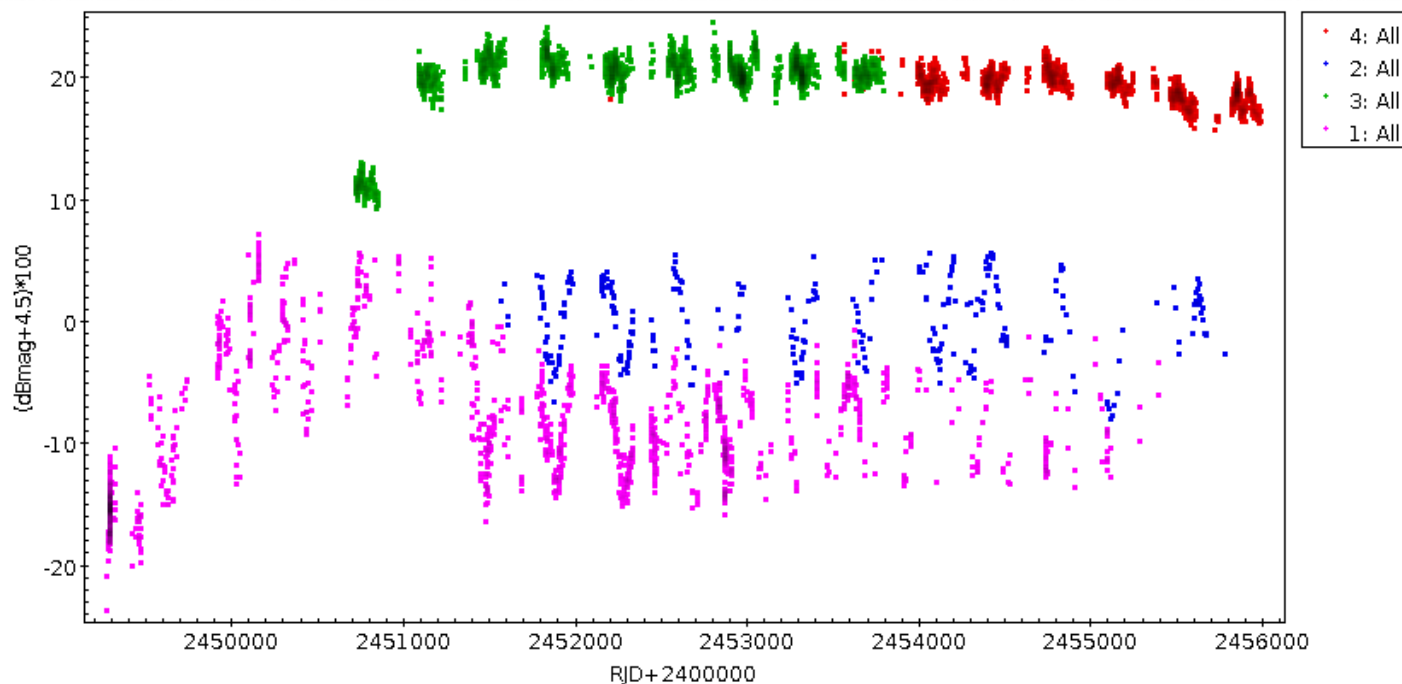
□ Time series : what parameters ?

- Should be some sort of $\text{Param} = f(\text{time})$
- Time :
 - JD, MJD, HJD, JD-xxxxxxx, phase
- Param = Y-axis :
 - Flux
 - Magnitude
 - Differential magnitude
 - Color
 - Counts
 - Relative intensity
 - Radial Velocity
 - ...

Extracting time series data

- Cone-Search like approach not sufficient
 - Many datasets identified by target name
 - Same target can have multiple names !
- Add standardized parameters (TIME) to output, but need to **keep all original parameters & description (provenance) !**

Time Series
for
gamma Cas



□ Simple(?) time series for Data Provider

- In any case, some metadata and mapping will probably have to be added to Vizier
 - This is a difficult and time-consuming task
 - Make it right the first time !
- Only deal with large missions ?
 - But catalogues dedicated to one source are very important pieces of data
- 90/10 rule for existing catalogues (use popularity)
- Keep it easy for new catalogue creation (more and more with time series → 250 new catalogues last year)

□ Simple(?) time series

- Today : extracting time series information from VizieR for a given target is very time consuming, and can be frustrating
- Some improvements could
 - Ease the work of the scientists
 - Give more visibility/reuse of existing data
- A time series standard should
 - Not mandate too many metadata (otherwise it won't be characterized properly)
 - Allow for dataset-specific parameters : flags, S/N, ...
- Provide authors with guidelines on standard parameters & needed metadata when submitting catalogue