

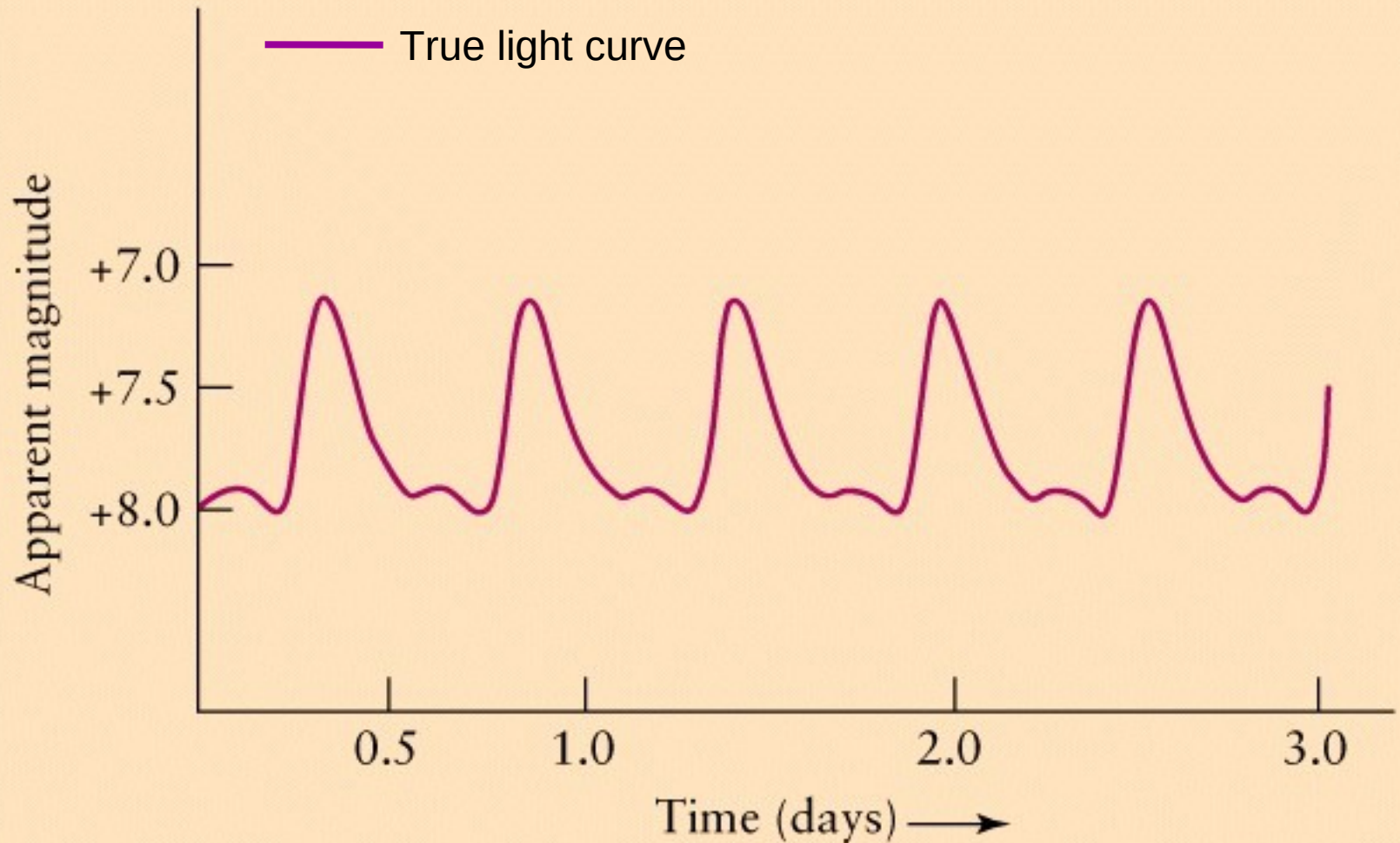
The distance of the Magellanic clouds

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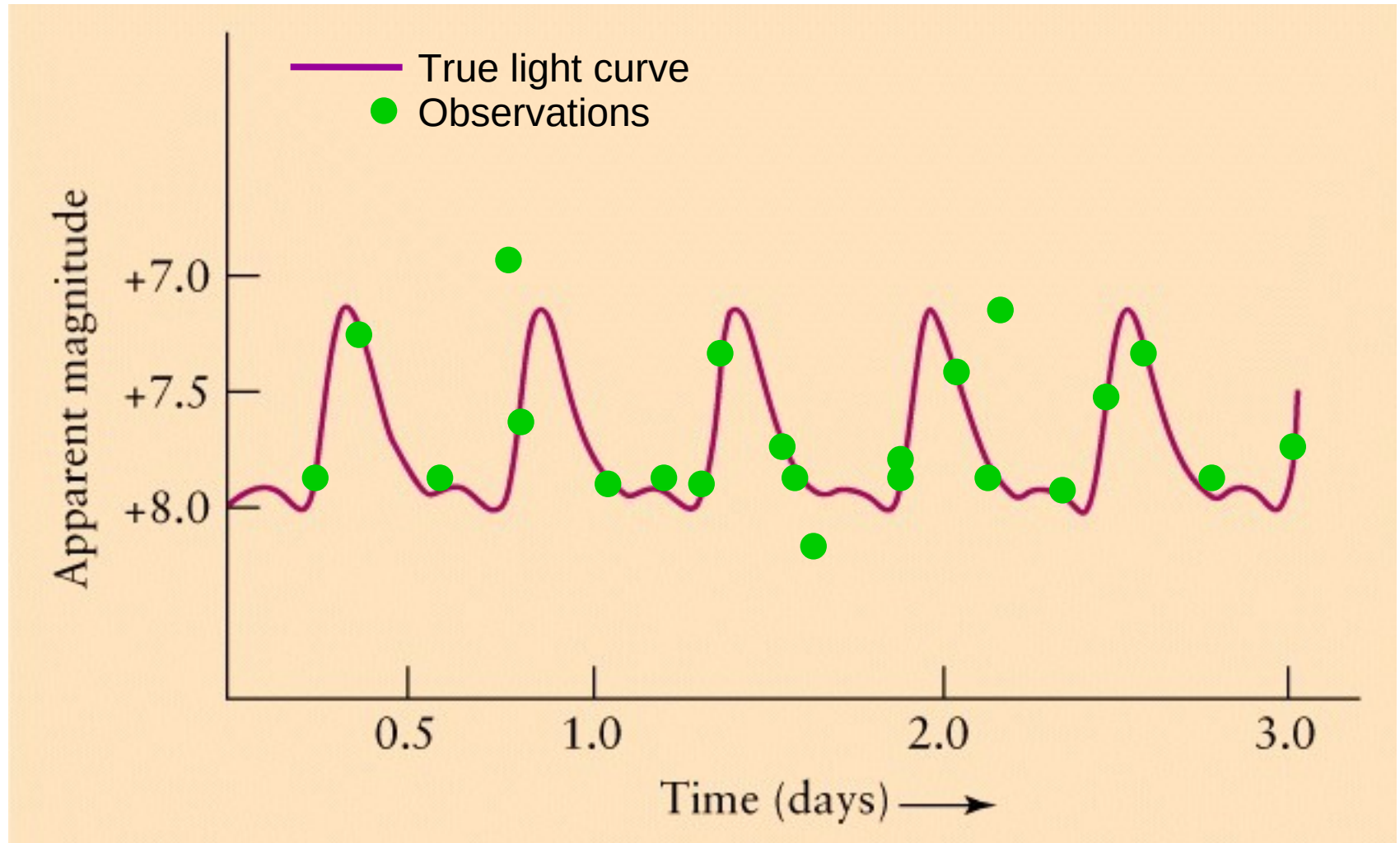
Contents

- Time series of variable stars
- Fit of the light curves
- Mean magnitudes
- Period Wesenheit relations for distance estimate

What is a time series?



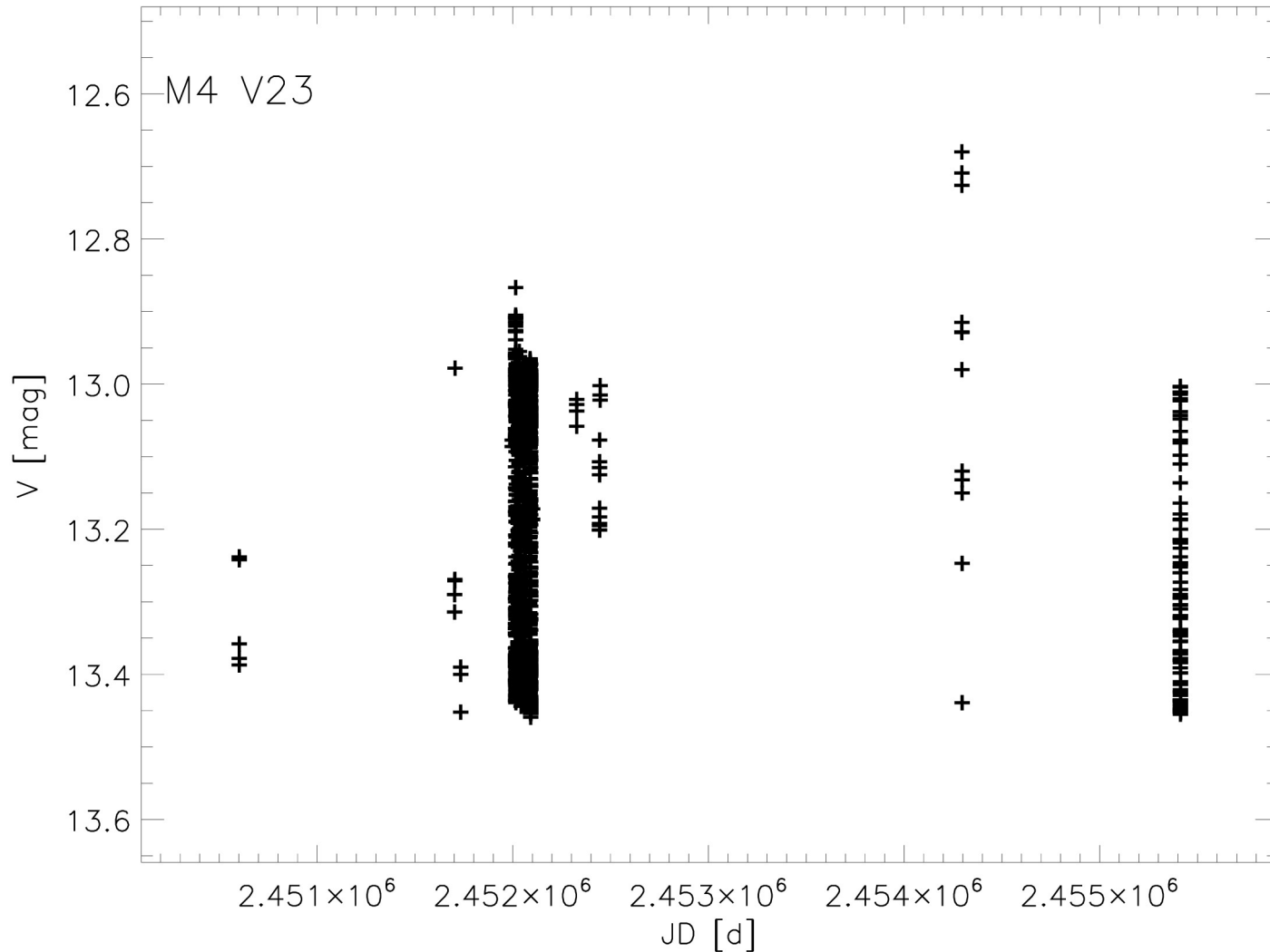
What is a time series?



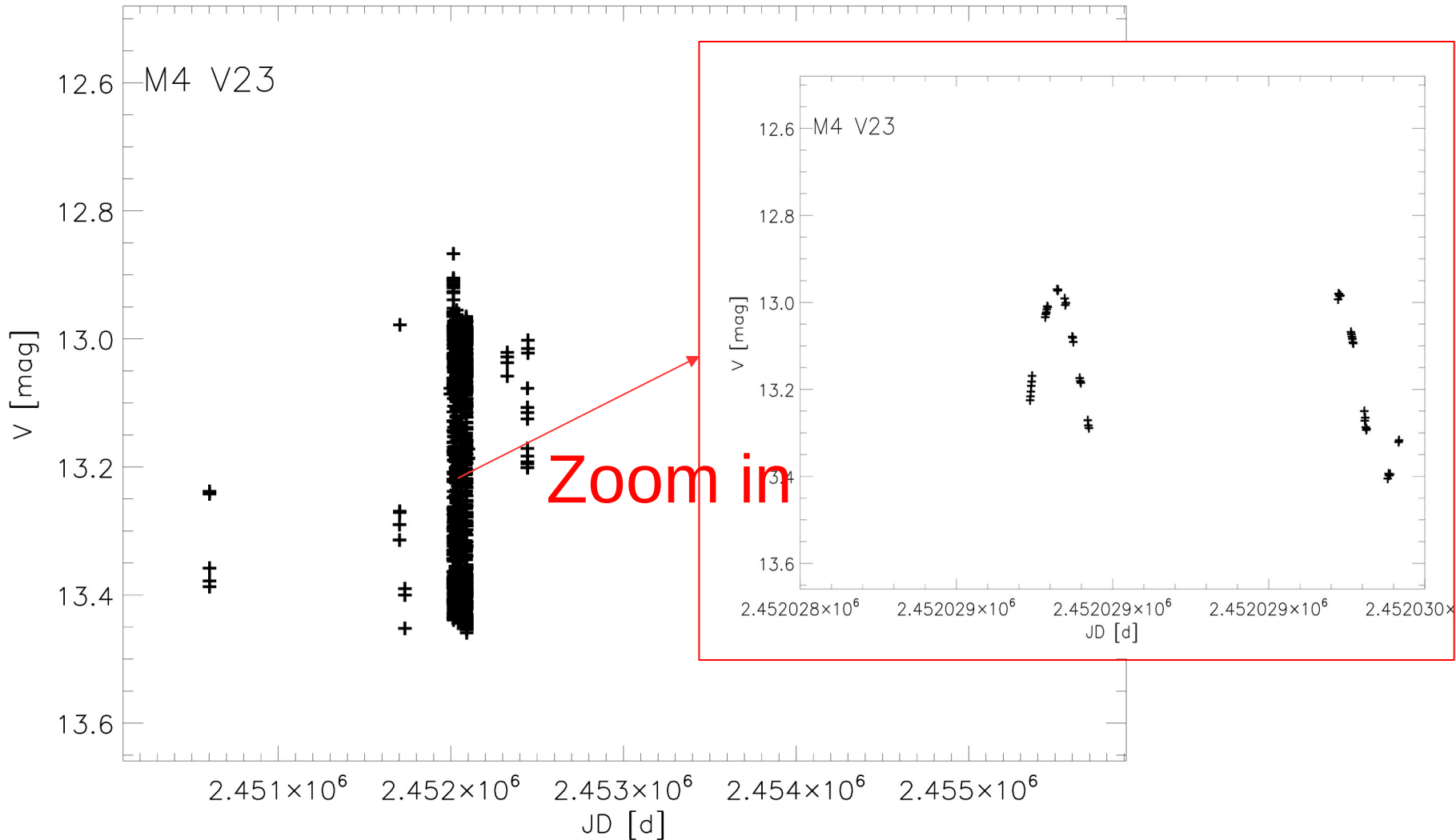
What is a time series?

mag	error	filter		JD			Dataset
13.242	0.0146	1	1	2450601.7136	2.38	0.052	bond5:obj5105.als
13.238	0.0147	1	1	2450601.7144	2.44	0.083	bond5:obj5106.als
13.358	0.0148	1	1	2450601.7336	2.25	0.054	bond5:obj5204.als
13.378	0.0155	1	1	2450601.7547	2.44	0.078	bond5:obj5403.als
13.387	0.0169	1	1	2450601.7641	2.69	0.177	bond5:obj5503.als
13.086	0.0202	1	1	2451996.8152	3.54	0.006	bond7:obj5203.als
13.077	0.0240	1	1	2451996.8334	5.70	0.031	bond7:obj5207.als
13.265	0.0080	1	1	2452013.6910	3.70	1.338	danish:dfsc0086.als
13.296	0.0083	1	1	2452013.6921	3.19	1.252	danish:dfsc0087.als
13.337	0.0120	1	1	2452013.7073	4.98	1.385	danish:dfsc0099.als
13.330	0.0078	1	1	2452013.7081	3.52	1.304	danish:dfsc0100.als
13.330	0.0151	1	1	2452013.7090	5.85	0.894	danish:dfsc0101.als
13.336	0.0126	1	1	2452013.7098	5.12	1.135	danish:dfsc0102.als
13.343	0.0097	1	1	2452013.7107	3.96	0.851	danish:dfsc0103.als
13.344	0.0141	1	1	2452013.7115	5.38	0.699	danish:dfsc0104.als
13.345	0.0133	1	1	2452013.7124	5.30	1.063	danish:dfsc0105.als
13.364	0.0155	1	1	2452013.7131	4.32	1.149	danish:dfsc0106.als
13.389	0.0181	1	1	2452013.7393	5.89	0.429	danish:dfsc0115.als
13.408	0.0135	1	1	2452013.7427	3.00	0.693	danish:dfsc0116.als
13.389	0.0103	1	1	2452013.7456	3.15	0.863	danish:dfsc0117.als
13.374	0.0186	1	1	2452013.7490	7.57	0.645	danish:dfsc0118.als
13.376	0.0235	1	1	2452013.7510	8.52	0.479	danish:dfsc0119.als
13.379	0.0213	1	1	2452013.7529	8.32	0.618	danish:dfsc0120.als
13.382	0.0221	1	1	2452013.7548	8.29	0.518	danish:dfsc0121.als
13.379	0.0144	1	1	2452013.7567	6.49	0.770	danish:dfsc0122.als
13.309	0.0115	1	1	2452013.7977	3.22	0.633	danish:dfsc0140.als
13.219	0.0140	1	1	2452013.8094	3.91	0.546	danish:dfsc0150.als
13.176	0.0167	1	1	2452013.8113	6.98	0.523	danish:dfsc0151.als
13.162	0.0174	1	1	2452013.8133	7.27	0.611	danish:dfsc0152.als
13.143	0.0207	1	1	2452013.8152	8.02	0.575	danish:dfsc0153.als
13.128	0.0182	1	1	2452013.8171	7.45	0.601	danish:dfsc0154.als
13.114	0.0152	1	1	2452013.8190	6.78	0.708	danish:dfsc0155.als
13.028	0.0292	1	1	2452013.8642	6.13	0.594	danish:dfsc0174.als
12.979	0.0090	1	1	2452013.8776	2.71	0.254	danish:dfsc0185.als
12.957	0.0158	1	1	2452013.8792	6.33	0.430	danish:dfsc0186.als
12.960	0.0143	1	1	2452013.8809	5.89	0.433	danish:dfsc0187.als
12.960	0.0129	1	1	2452013.8826	5.46	0.402	danish:dfsc0188.als
12.961	0.0137	1	1	2452013.8843	5.47	0.325	danish:dfsc0189.als

What is a time series?



What is a time series?



How to get time series

Depends on what you want...

How to get time series

Depends on what you want...

General Catalog Query Engine
powered by Gator

Quick Guide | Tutorial | **Catalog List** | Process Monitor | Program Interface

CATALOG SELECTION: **WISE**

Selection	Descriptions	# Columns	# Rows	Information
<input type="radio"/>	AllWISE Source Catalog	334	747634026	i
<input checked="" type="radio"/>	AllWISE Multiepoch Photometry Table	48	42759337365	i
<input type="radio"/>	AllWISE Reject Table	334	428787253	i
<input type="radio"/>	AllWISE Atlas Metadata Table	349	18240	i
<input type="radio"/>	AllWISE Frame Cross-Reference Table	6	21208389	i
<input type="radio"/>	AllWISE Atlas Inventory Table	7	18240	i
<input type="radio"/>	AllWISE Atlas Image Inventory Table	76	72960	i
<input type="radio"/>	AllWISE Refined Pointing Information for the Single-exposure Images	23	2786053	i

WISE Mid-Infrared photometry

ASAS-SN Variable Stars Database

Using in Publications

When using ASAS-SN light curves in publications cite: Shappee et al. (2014) and either: (i) The ASAS-SN Catalog of Variable Stars I: Jayasinghe et al. (2018a) (ii) The ASAS-SN Catalog of Variable Stars II: Jayasinghe et al. (2018b), (iii) The ASAS-SN Catalog of Variable Stars III: Jayasinghe et al. (2019), (iv) The ASAS-SN Catalog of Variable Stars IV: Jayasinghe et al. (2020), or (v) The ASAS-SN Catalog of Variable Stars V: Jayasinghe et al. (2021), or (vi) The ASAS-SN Catalog of Variable Stars X: Christy et al. (2022).

Database Updated: 08/10/2021 (Crossmatches to Gaia DR3, TIC v8, and GALEX GR6+7 AS added)

Search Light Curves

Right Ascension: Declination: Radius (arcmin):

Mean VMag: Amplitude: Period:

KLST Statistic: Class Probability: Parallax/Parallax Error:

ASAS-SN or Other Name: Variable Type:

References: Sort By:

Reset Search

ASAS-SN optical photometry

VSA - VISTA Science Archive

The VISTA Science Archive (VSA) holds the image and catalogue data products generated by VIRCAM on the Visible and Infrared Survey Telescope for Astronomy (VISTA). The primary contents of the archive originate from the VISTA Public Surveys. Survey science-ready catalogue data will be released in phases, while standard flat-file data products (both images and derived single passband catalogues) become available continually after routine observation and processing operations. Information on the various archive releases can be found on the [surveys page](#).

The history of archive releases, updates and bug fixes is recorded under the [release history](#) page. Users wishing to receive email announcements of such entries should subscribe to the VSA Announcelist (contact vsa-support@roe.ac.uk).

Picture: Sky coverage of VISTA surveys, overlaid on a 2MASS image of the whole sky. Credit: VISTA

VISTA Near-Infrared photometry

GaiaPortal DR3

Version 3.2.0

Home | Gaia DR3 | Survey of Surveys | Gaia Only Query | Gaia Spec Tool | Data Models and Statistics

Query Form | Query Result

Search In

Gaia DR3 Main Table	Variable Objects	Non-single Objects	Extragalactic Objects	Epoch Data	Spectroscopy	Astrophysical Parameters
<ul style="list-style-type: none">NoneGalSource	<ul style="list-style-type: none">NonevarSummaryvarCataloguevarRRLyzevarLongPeriodVariablevarShortPeriodVariablevarHubbleBasevarRadialVelocityvarTransitvarClassifiedResultvarMultiwavelengthvarRadialVelocity	<ul style="list-style-type: none">NoneNSACalibrationDataNSISLineSpectroNSISBodyOrbitNSISNetNSISCompactCompanionNSISBinaryvarPlanetaryTransitvarPlanetaryTransit	<ul style="list-style-type: none">NoneGalaxyCandidatesQCCandidatesPMWScandidatesPMWScandidatesvarQuasar	<ul style="list-style-type: none">NoneepochPhotometryvarEpochRadialVelocityvarEpochRadialVelocity	<ul style="list-style-type: none">NoneRVStreamSpectrumXPsummaryXPsampledNearSpectrum	<ul style="list-style-type: none">NoneAstrophysicalParametersAstrophysicalParametersSupp

Gaia Optical photometry

Gaia time series

Gaia portal at ASI:

<http://gaiaportal.asdc.asi.it/DR3/GODR3/query/form>

SSDC **GaiaPortal DR3** Version 3.2.0

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Gaia only query [Reset Query Form](#)

Search In

Gaia DR3 Main Table	Variable Objects	Non-single Objects	Extragalactic Objects	Epoch Data	Spectroscopy	Astrophysical Parameters
<input type="checkbox"/> None <input checked="" type="checkbox"/> GaiaSource <input type="checkbox"/> FPRRadVelFieldSource	<input type="checkbox"/> None <input type="checkbox"/> variSummary <input type="checkbox"/> variCepheid <input checked="" type="checkbox"/> variRRLYae <input type="checkbox"/> variLongPeriodVariable <input type="checkbox"/> FPRvariLongPeriodVariable <input type="checkbox"/> variShortTimescale <input type="checkbox"/> variMsOscillator <input type="checkbox"/> variRotationModulation <input type="checkbox"/> variMicrolensing <input type="checkbox"/> variClassifierResult <input type="checkbox"/> FPRvariRadVelStatistics <input type="checkbox"/> variRadVelStatistics	<input checked="" type="checkbox"/> None <input type="checkbox"/> NSSAccelerationAstro <input type="checkbox"/> NSSnonLinearSpectro <input type="checkbox"/> NSStwoBodyOrbit <input type="checkbox"/> NSSvImFI <input type="checkbox"/> variCompactCompanion <input type="checkbox"/> variEclipsingBinary <input type="checkbox"/> variPlanetaryTransit <input type="checkbox"/> variPlanetaryTransit13june2022	<input checked="" type="checkbox"/> None <input type="checkbox"/> GalaxyCandidates <input type="checkbox"/> QSOcandidates <input type="checkbox"/> FPRlensCandidates <input type="checkbox"/> FPRlensObservation <input type="checkbox"/> FPRlensOutlier <input type="checkbox"/> variAGN	<input type="checkbox"/> None <input checked="" type="checkbox"/> epochPhotometry <input type="checkbox"/> variEpochRadialVelocity <input type="checkbox"/> FPRvariEpochRadialVelocity	<input checked="" type="checkbox"/> None <input type="checkbox"/> RVsmeanSpectrum <input type="checkbox"/> XPsummary <input type="checkbox"/> XPsampledMeanSpectrum	<input checked="" type="checkbox"/> None <input type="checkbox"/> AstrophysicalParameters <input type="checkbox"/> AstrophysicalParametersSupp

GaiaSource variCepheid epochPhotometry

Gaia time series

Gaia portal at ASI:

<http://gaiaportal.asdc.asi.it/DR3/GODR3/query/form>

Source

To enable Random Sample, select only Gaia Source in Search-in box

Target Name:

Position:

Globular cluster M4: has some RRLs, all at the same distance

Target In:

☒ Circle

☐ Range

Radius:

Gaia time series

Gaia portal at ASI:

<http://gaiaportal.asdc.asi.it/DR3/GODR3/query/form>

Define Output

Gaia DR3 Main Table

GaiaSource

☐ All Fields ☐ No Fields

- ☐ GaiaSource solutionId
- ☐ GaiaSource refEpoch
- ☐ GaiaSource DECError

- ☐ GaiaSource designation
- ☒ GaiaSource RA
- ☐ GaiaSource parallax

- ☐ GaiaSource sourceId
- ☐ GaiaSource RAerror
- ☐ GaiaSource parallaxError

- ☐ GaiaSource randomIndex
- ☒ GaiaSource DEC
- ☐ GaiaSource parallaxOverError

RA

DEC

Variable Objects

variRRLyrae

☐ All Fields ☐ No Fields

- ☒ variRRLyrae solutionId
- ☒ variRRLyrae p1O
- ☒ variRRLyrae epochBP
- ☒ variRRLyrae epochRV
- ☒ variRRLyrae intAverageBP
- ☒ variRRLyrae averageRV
- ☒ variRRLyrae peakToPeakBP
- ☒ variRRLyrae peakToPeakRV
- ☒ variRRLyrae r21G
- ☒ variRRLyrae phi21G
- ☒ variRRLyrae numCleanEpochsG
- ☒ variRRLyrae zpMagG
- ☒ variRRLyrae numHarmonicsForP1BP
- ☒ variRRLyrae referenceTimeBP
- ☒ variRRLyrae fundFreq1Error
- ☒ variRRLyrae bestClassification

- ☒ variRRLyrae sourceId
- ☒ variRRLyrae p1Oerror
- ☒ variRRLyrae epochBPError
- ☒ variRRLyrae epochRVError
- ☒ variRRLyrae intAverageBPError
- ☒ variRRLyrae averageRVError
- ☒ variRRLyrae peakToPeakBPError
- ☒ variRRLyrae peakToPeakRVError
- ☒ variRRLyrae r21GError
- ☒ variRRLyrae phi21GError
- ☒ variRRLyrae numCleanEpochsBP
- ☒ variRRLyrae zpMagBP
- ☒ variRRLyrae numHarmonicsForP1RP
- ☒ variRRLyrae referenceTimeRP
- ☒ variRRLyrae fundFreq2
- ☒ variRRLyrae Gabsorption

- ☒ variRRLyrae pf
- ☒ variRRLyrae epochG
- ☒ variRRLyrae epochRP
- ☒ variRRLyrae intAverageG
- ☒ variRRLyrae intAverageRP
- ☒ variRRLyrae peakToPeakG
- ☒ variRRLyrae peakToPeakRP
- ☒ variRRLyrae metallicity
- ☒ variRRLyrae r31G
- ☒ variRRLyrae phi31G
- ☒ variRRLyrae numCleanEpochsRP
- ☒ variRRLyrae zpMagRP
- ☒ variRRLyrae numHarmonicsForP1RV
- ☒ variRRLyrae referenceTimeRV
- ☒ variRRLyrae fundFreq2Error
- ☒ variRRLyrae GabsorptionError

- ☒ variRRLyrae pfError
- ☒ variRRLyrae epochGError
- ☒ variRRLyrae epochRPError
- ☒ variRRLyrae intAverageGError
- ☒ variRRLyrae intAverageRPError
- ☒ variRRLyrae peakToPeakGError
- ☒ variRRLyrae peakToPeakRPError
- ☒ variRRLyrae metallicityError
- ☒ variRRLyrae r31GError
- ☒ variRRLyrae phi31GError
- ☒ variRRLyrae numCleanEpochsRV
- ☒ variRRLyrae numHarmonicsForP1G
- ☒ variRRLyrae referenceTimeG
- ☒ variRRLyrae fundFreq1
- ☐ variRRLyrae fundFreq1HarmonicFile

Everything but the last one: variRRLyraefindFreq1HarmonicFile

Epoch Data

epochPhotometry

☐ All Fields ☐ No Fields

- ☐ epochPhotometry solutionId

- ☐ epochPhotometry sourceId

- ☐ epochPhotometry nTransits

- ☒ epochPhotometry LightCurveFile

epochPhotometryLightCurveFile

Submit

Reset Query Form

Gaia time series

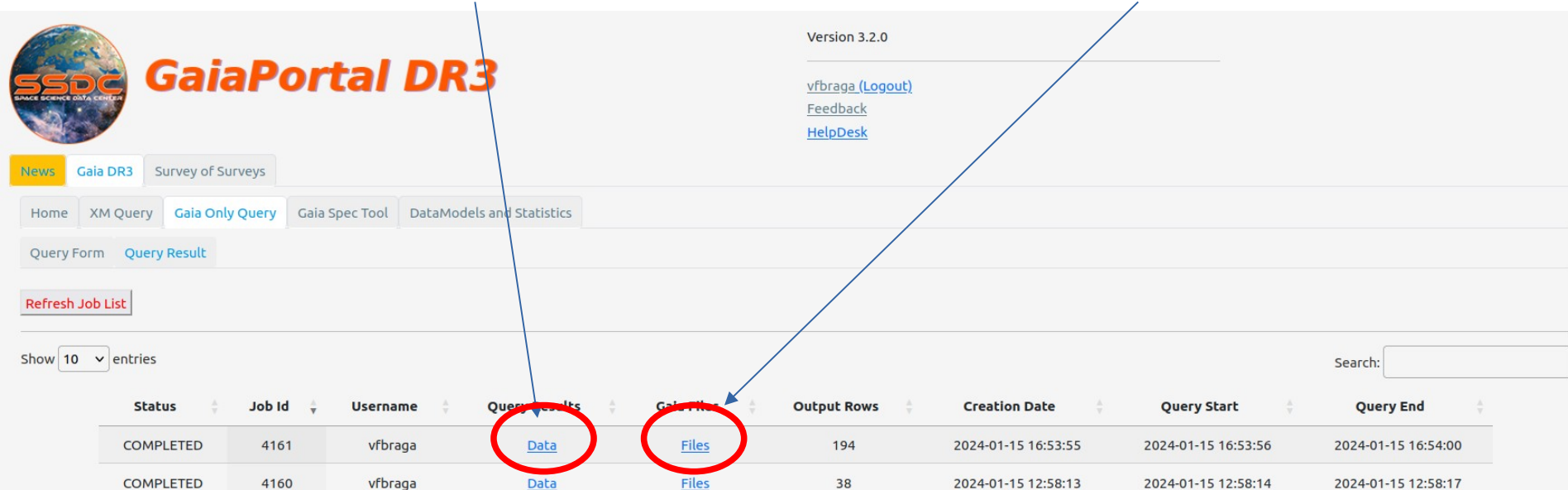
Gaia portal at ASI:

<http://gaiaportal.asdc.asi.it/DR3/GODR3/query/form>

Table of properties

You will get two files

Time series tar file



The screenshot shows the GaiaPortal DR3 interface. At the top left is the SSDC logo and the text 'GaiaPortal DR3'. Below this are navigation tabs: 'News', 'Gaia DR3', and 'Survey of Surveys'. A secondary row of tabs includes 'Home', 'XM Query', 'Gaia Only Query' (which is active), 'Gaia Spec Tool', and 'DataModels and Statistics'. Below these are 'Query Form' and 'Query Result' buttons, and a 'Refresh Job List' button. The main content area displays a table of query results. The table has columns: Status, Job Id, Username, Query Results, Gaia Files, Output Rows, Creation Date, Query Start, and Query End. Two rows are visible, both with status 'COMPLETED'. In the first row, the 'Query Results' and 'Gaia Files' links are circled in red. A blue arrow points from the 'Table of properties' text to the 'Data' link in the first row. Another blue arrow points from the 'You will get two files' text to the 'Files' link in the first row. A third blue arrow points from the 'Time series tar file' text to the 'Files' link in the first row. The table data is as follows:

Status	Job Id	Username	Query Results	Gaia Files	Output Rows	Creation Date	Query Start	Query End
COMPLETED	4161	vfbraga	Data	Files	194	2024-01-15 16:53:55	2024-01-15 16:53:56	2024-01-15 16:54:00
COMPLETED	4160	vfbraga	Data	Files	38	2024-01-15 12:58:13	2024-01-15 12:58:14	2024-01-15 12:58:17

The time series archive has a complicated structure: to unzip it, follow these steps from command line:

```
> tar --strip-components=7 -xvf result_*.list.tar
> ls *zip | awk '{print "unzip "$1}' > unzip_files
> source unzip_files
```

Gaia time series

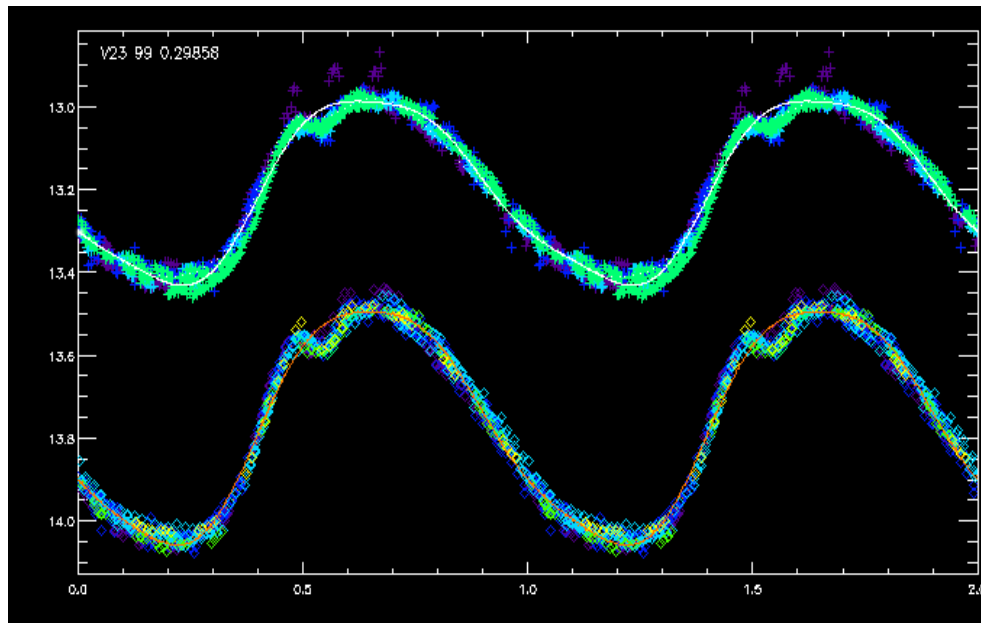
Structure of a light curve file:

rpObsTime			rpFluxOverError			rpMag				
FluxError	bpFluxOverError	bpMag	rpObsTime	rpFlux	rpFluxError	rpFluxOverError	rpMag	photometryFlagNoisyData	variabilityFlagGReject	variabilityFlagBpReject
4.27118290784531	473.34903	13.252639482755896	1710.4715044617257	94208.75491764495	152.97383553647464	515.8488	12.312667340888328	1	0	0
1.8965240828027	388.9086	13.483993949145619	1710.3455032302223	84968.99263554292	151.81718707639055	559.6797	12.424744327577358	1	0	0
.02125982247544	372.0365	14.05060935690214	1742.849102633857	58948.59294189628	118.16969869845126	498.84695	12.821711892965464	0	0	0
.06155658796604	361.9702	14.055511467603507	1742.9231036183241	56694.01760267621	117.21226109191105	483.68674	12.864052415616348	0	0	0
								0	0	1
9.83116593450933	563.2906	13.097701018903198	1913.626801013107	100162.66673230626	151.53473234613668	660.98816	12.246130804447318	1	0	0
6.33087158751565	471.93658	13.317347565881704	1913.7008153018307	91675.52197574612	145.20492890259604	631.35266	12.34226202266573	0	0	0
3.70414404379845	381.69977	13.844747177571048	1913.8769853517638	69771.27627769508	131.63974923768976	530.0168	12.638703832903754	0	0	0
								1	0	1
.56997426437657	343.3843	14.05970796422756	1926.8833673571673	56648.93156298144	119.55706401925225	473.82336	12.864916193179363	0	1	0
1.20051238006457	540.5431	12.80274380891083	1926.9573811232815	122718.44867010706	178.12688643214437	688.93835	12.025620859753817	1	1	0
2.8276379111259	841.20337	12.108703361099835	1927.13355348338	258469.6006326943	249.3578714121709	1036.5408	11.216871821688274	0	1	0
.31493468796963	379.01465	14.039180866527252	2022.4422393771292	64748.56204629118	121.1050504792458	534.6479	12.719820181329151	1	0	0
9.85449594101064	582.26904	13.142090488772451	2022.6923894413603	100926.00301195565	150.1164233735486	672.3182	12.237887815748286	0	0	0
.47802635547022	351.6433	14.058189907654729	2022.9425382135582	60261.8112992995	117.42236055353128	513.20557	12.797790048166888	1	0	0
.91922553146262	390.29147	14.024843644508083	2023.0165410218485	59935.780855085104	115.81529657577288	517.5118	12.803680081717953	0	0	0
1.73831480684558	552535	13.18336253759433	2023.192685953697	99222.60705624733	152.25655283320057	651.68036	12.256368916504918	0	0	0
4.46929337081541	468.77997	13.613647937806741	2023.2666885903955	79463.88101180292	133.40973530831076	595.6378	12.497471070761714	0	0	0
.0287155561006	370.96732	14.053642224619944	2023.442832964355	60146.66395113605	119.18951811514235	504.6305	12.799866640908952	1	0	0
.31107912941555	382.12338	14.00576982858021	2023.5168354464304	60704.279171239315	118.79859912970163	510.9848	12.789847234959375	1	0	0
8.6108563953472	547.65155	13.219087370488662	2023.6929794606167	97144.48237093657	151.12876616111643	642.7928	12.279350154896097	0	0	0
4.93306859985911	454.76627	13.64179069591178	2023.766981860596	78253.55166275585	134.07381979489168	583.6602	12.514135356613782	1	0	0
								0	0	1
.73303282365319	383.3389	14.009371703575601	2024.0171280524937	60256.84097855194	117.87598121859807	511.18845	12.797879602058938	0	0	0
6.7512070963698	535.5391	13.259183950042438	2024.1932718730952	95580.43505519928	150.2756050087872	636.0343	12.296972993716281	1	0	0
3.69191071917733	447.46866	13.672273465119613	2024.2672743059456	77317.98237574169	133.3817380377334	579.67444	12.527194219841553	1	0	0
.83524417857808	369.55765	14.060164695741742	2024.4434183021929	59500.41412859127	119.3588880474468	498.50006	12.811595529978806	1	0	0
5.63735286135437	523.5123	13.293428041248527	2024.6935652159866	93453.15839498705	150.09089157045284	622.6438	12.321410542101985	0	0	0
0.64909183620694	450.26697	13.697842317724522	2024.7675678672204	76252.68755351467	130.65953693126528	583.5983	12.542257613268497	0	0	0
.02061078303798	367.82407	14.075386584878853	2024.9437127988938	58784.07676509749	117.51433670962506	500.22897	12.82474624674551	1	0	0
0.03432436629463	526.2426	13.33731359915072	2025.1938613098973	91207.29020971549	143.30937716478442	636.4363	12.347821618839225	0	0	0
4.2655967994689	382.3869	14.053302445920044	2025.4440109633463	59131.226516425195	115.65975073837812	511.25156	12.818353282779526	0	0	0
7.5436828539764	522.56104	13.367701451353138	2025.694161964266	89668.71203698614	141.40766438151365	634.1149	12.36629317169558	0	0	0
								1	0	1

These are the Rp band data, there are also G and Bp!

Uncertainty on magnitude for each point: $2.5 / (\ln(10) * \text{rpFluxOverError})$

Mean magnitude estimate



Phasing: fold the lightcurve with the period that minimizes the χ^2

$$\phi_i = ((t_i - t_0)/P) \% 1$$

Remainder of the division by 1: just pick the decimal figures

Mean magnitude estimate

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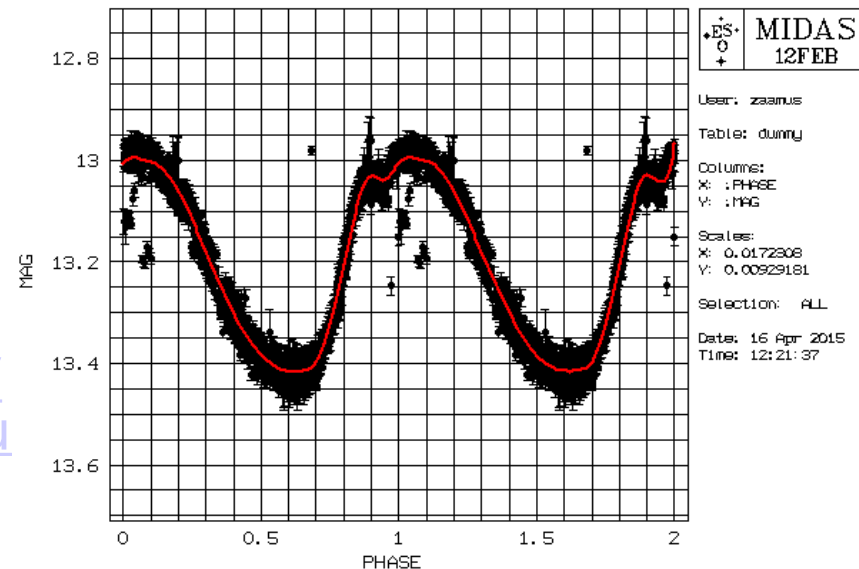
$$\phi_i = ((t_i - t_0)/P) \% 1$$

Remainder of the division by 1: just pick the decimal figures

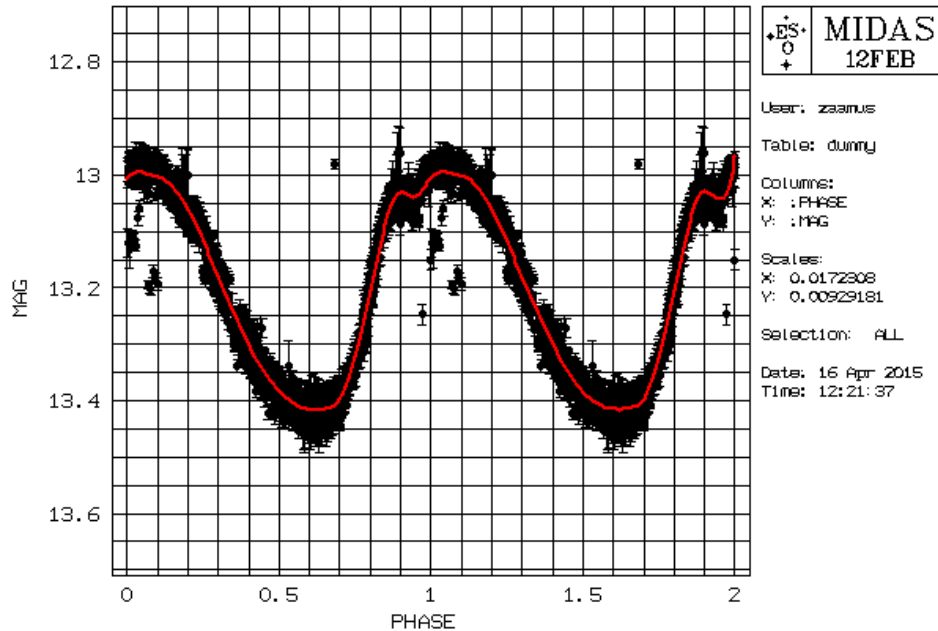
On the folded light curve, fit with a Fourier series

Code for Fourier series fit

<https://drive.google.com/file/d/1ysZTIVAUuzP0NrTh95rvatcyk1gZNqdo/view?usp=sharing>



Mean magnitude estimate



Mean magnitude is a logarithmic quantity --> **intensity** average over the cycle

One cannot calculate $\langle \text{mag} \rangle$ integrating the fit as it is: all the points of the fit must be converted to intensity

$$I_i = 10^{(-0.4 * \text{mag}_i)}$$

for each phase point of the fit (i)

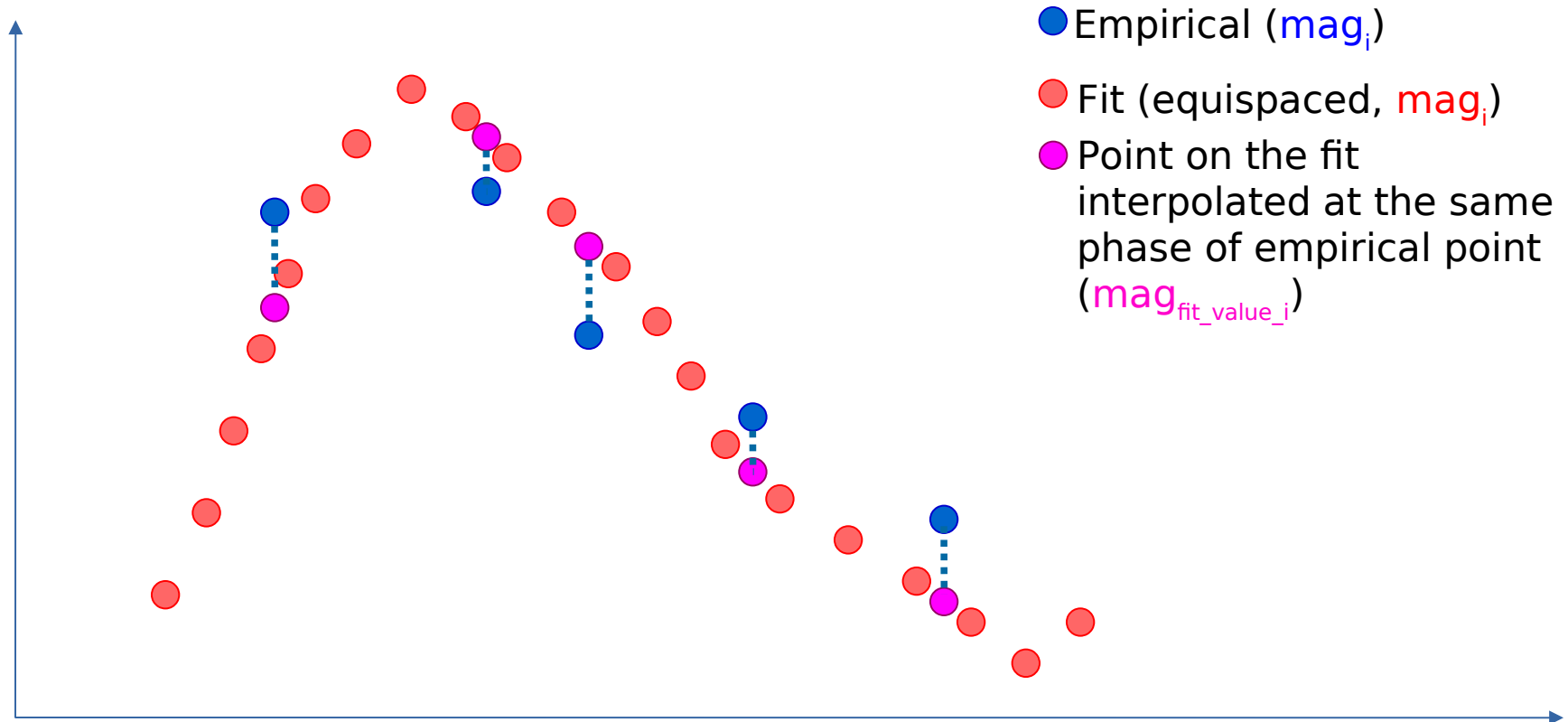
Now you can calculate the mean intensity $\langle I \rangle$...

... and estimate $\langle \text{mag} \rangle$

$$\langle I \rangle = ((I_1 + I_n)/2 + \sum_{i=2, n-1} (I_i)) / n$$

$$\langle \text{mag} \rangle = -2.5 \log_{10}(\langle I \rangle)$$

Mean magnitude estimate



$$\text{err}\langle\text{mag}\rangle = (\sum_i (\text{mag}_i - \text{mag}_{\text{fit_value}_i})^2 / (n-1))^{1/2}$$

n : number of phase
points

Period Wesenheit relation

PL relations should be corrected by extinction... but this
can be a complicated task

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So, we define the Wesenheit magnitude (or pseudo-magnitude)

$$W_{YZ}^X = X - \left(\frac{A_Y}{A_X} - \frac{A_Z}{A_X} \right)^{-1} (Y - Z)$$

Ratios of extinction
between different
passbands

e.g. (X=G=Bp ; Y=Rp)

$$W_{BR}^G = G - 1.90 (Bp - Rp)$$

Ripepi+2023

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Ripepi+2023

- Independent of reddening by construction assuming an universal reddening law
- Mimics a PLC relation ($\sigma \sim 0.03$)
- Some combinations of bands (VBV, VBI) give metal-independent PW relations.

$$W_{YZ}^X = a + b * \log P$$

Period Wesenheit relation

Type	Mode	α	β	σ_{ABL}	Band
All sky					
DCEP	F	-2.744 ± 0.045	-3.391 ± 0.052	0.015	$W(G, G_{\text{BP}} - G_{\text{RP}})$
DCEP	1O	-3.224 ± 0.028	-3.588 ± 0.065	0.021	$W(G, G_{\text{BP}} - G_{\text{RP}})$
T2CEP	-	-1.224 ± 0.039	-2.542 ± 0.088	0.041	$W(G, G_{\text{BP}} - G_{\text{RP}})$

Ripepi+(2023) Table 3

Different pulsation modes follow different PL/PW relations

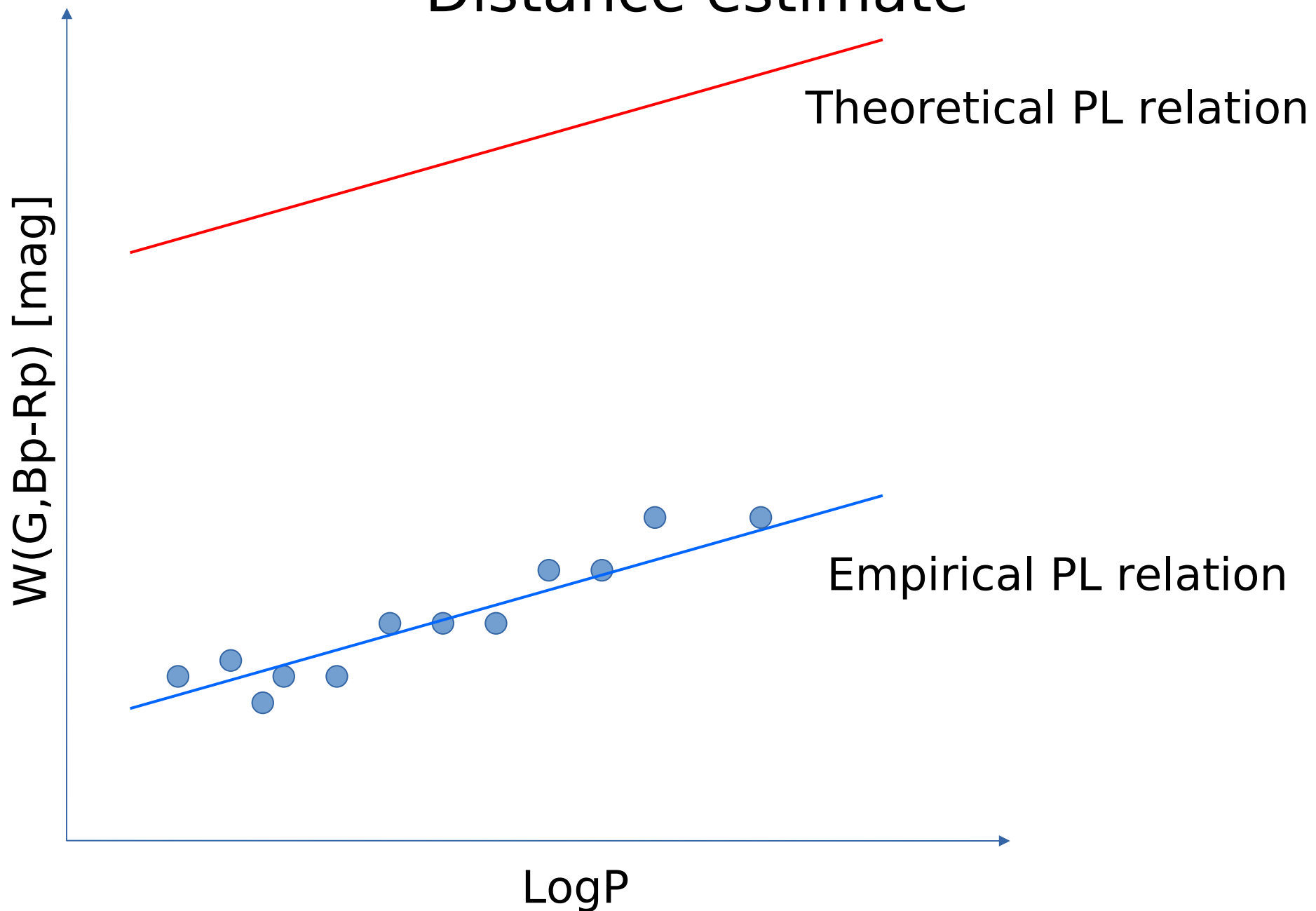
Each of you can decide to use either DCEP-F,
DCEP-1O or T2CEP

Select the type of variable from the result table (columns
variCepheid_typeBestClassification and
variCepheid_modeBestClassification)

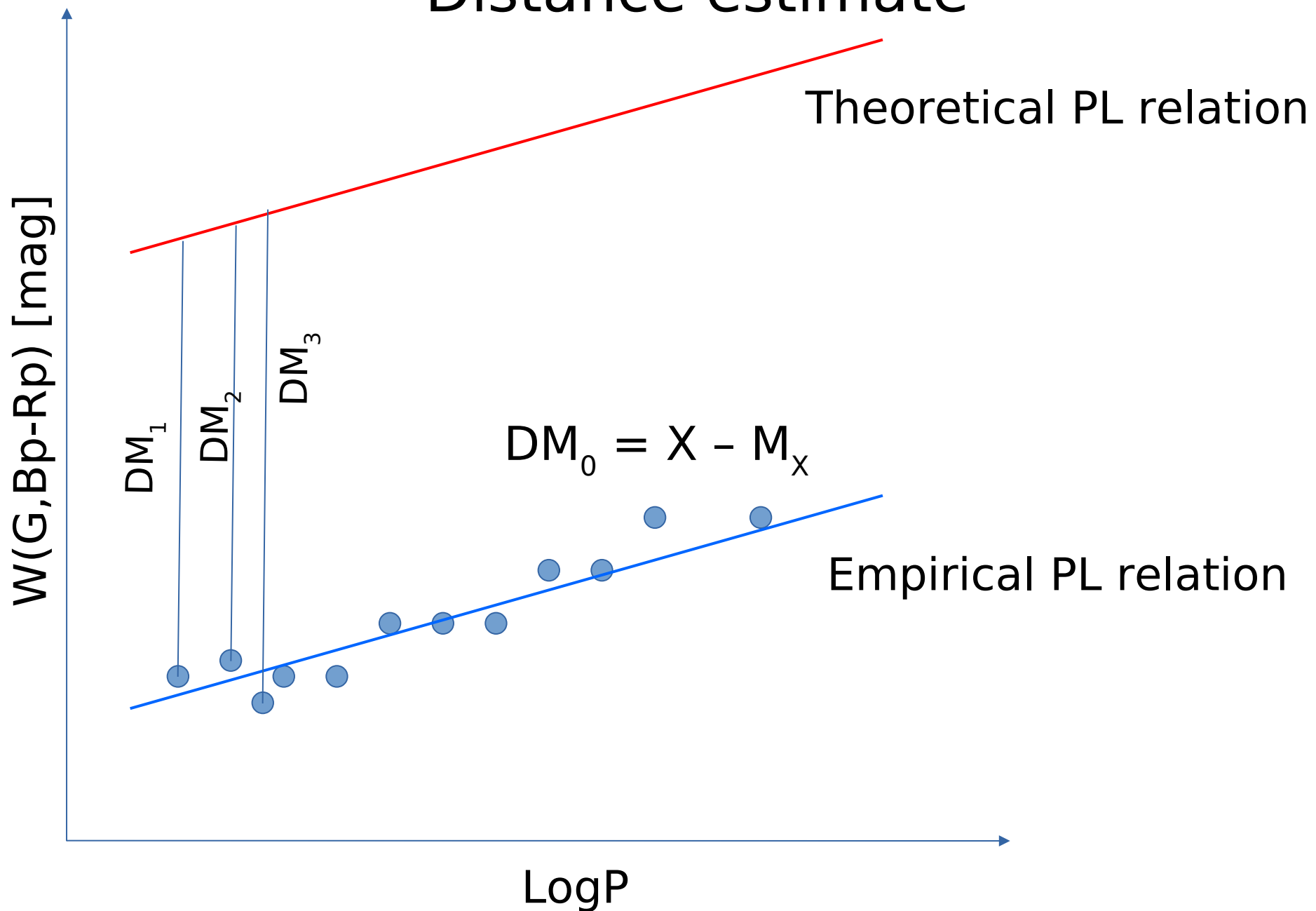
Table Browser for 36: result_JOB05208_v5gf794r4pv7r5i5r9v6s5rjrv.csv

	..variCepheid_...	variCepheid_...	variCe...	variCeph...	variCepheid_...	variCeph...	variCepheid_...	variCeph...	variCepheid_...	variCepheid_typeBestClassification	variCep...	variCepheid_mod...	variCe...
29	1737,8672	1695,99519		0,69294	4,49433E-6					DCEP		FIRST_OVERTONE	
30	1695,99505	1695,99513		1,27651	3,50297E-5	1,58466	8,07895E-6	0,63105	3,21725E-6	DCEP		MULTI	10/20
31	1695,99503	1695,99512		0,48073	1,15992E-5					DCEP		FIRST_OVERTONE	
32	1695,99502	1695,99511		0,02727	5,12221E-5					T2CEP	RV_TAU	NOT_APPLICABLE	
33	1737,79316	1737,79325		0,15079	3,38863E-6					DCEP		FUNDAMENTAL	
34	1695,99502	1695,99511		1,05581	1,68696E-5					DCEP		FIRST_OVERTONE	

Distance estimate



Distance estimate



Distance estimate

$\langle X \rangle$: mean value of X ; δX : error on X ; n : number of variables

1) Convert DM to distance for each variable

$$d = 10^{(DM_0 + 5)/5} \quad \sigma d/d = \ln(10) * \sigma DM_0 / 5$$

2) Calculate (weighted) average distance and error on the mean
[Bevington, Data reduction and error analysis, eq. 4.23]

$$\langle d \rangle = \sum_i (d_i * w_i) / \sum_i w_i \quad \sigma \langle d \rangle = (1/(n-1) * \sum_i w_i (d_i - \langle d \rangle)^2 / \sum_i w_i)^{1/2}$$

Where w_i are the weights: $w_i = 1/\sigma d_i^2$

3) Convert average distance to average DM (and error)

$$\langle DM_0 \rangle = 5 * \log_{10}(\langle d \rangle) - 5$$

$$\delta \langle DM_0 \rangle = 5 * \log_{10}(e) * \sigma \langle d \rangle / \langle d \rangle$$