

VSXplore: The Variable Star indeX Explorer

An Integrated Platform: Database, API, and Dashboard

Consolidated Slides

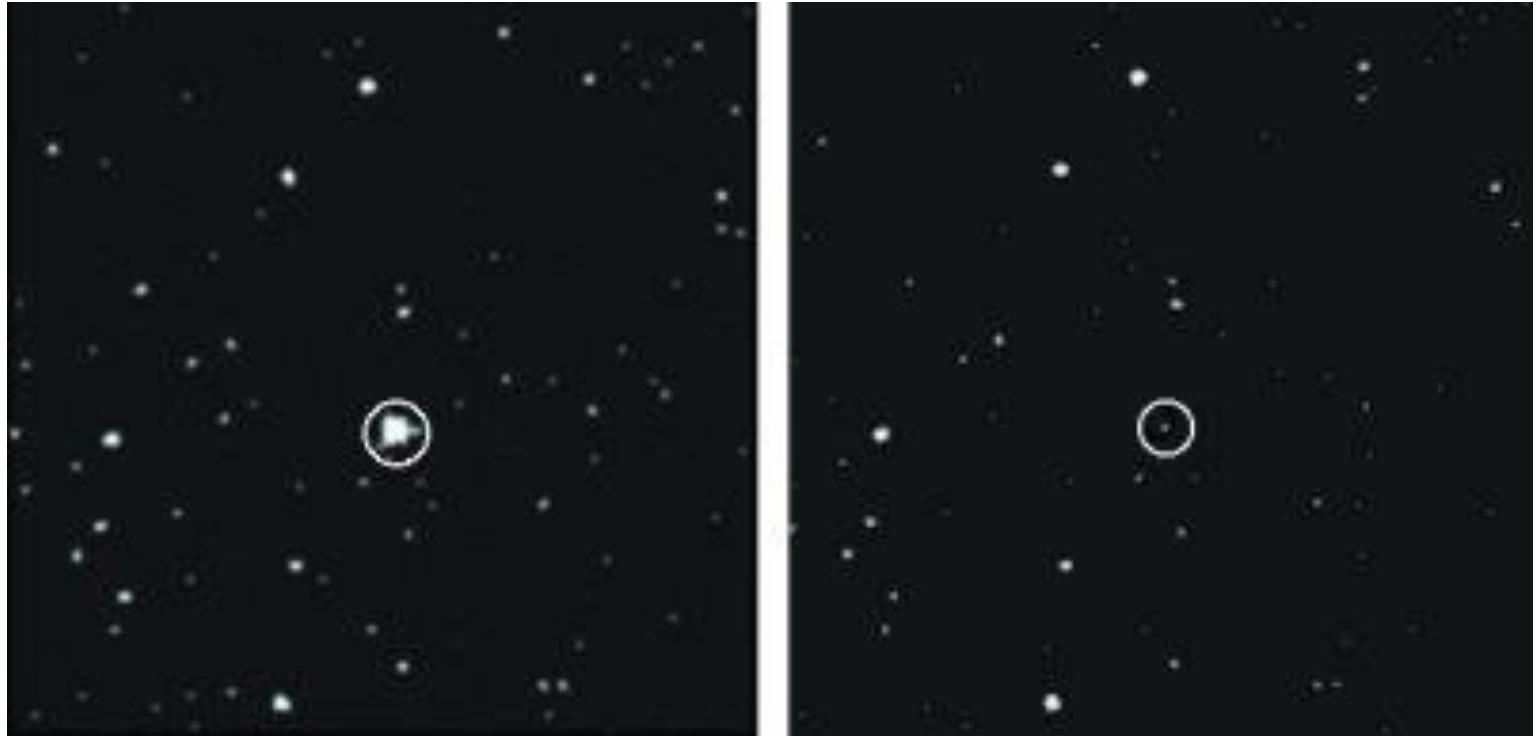


What are variable stars?

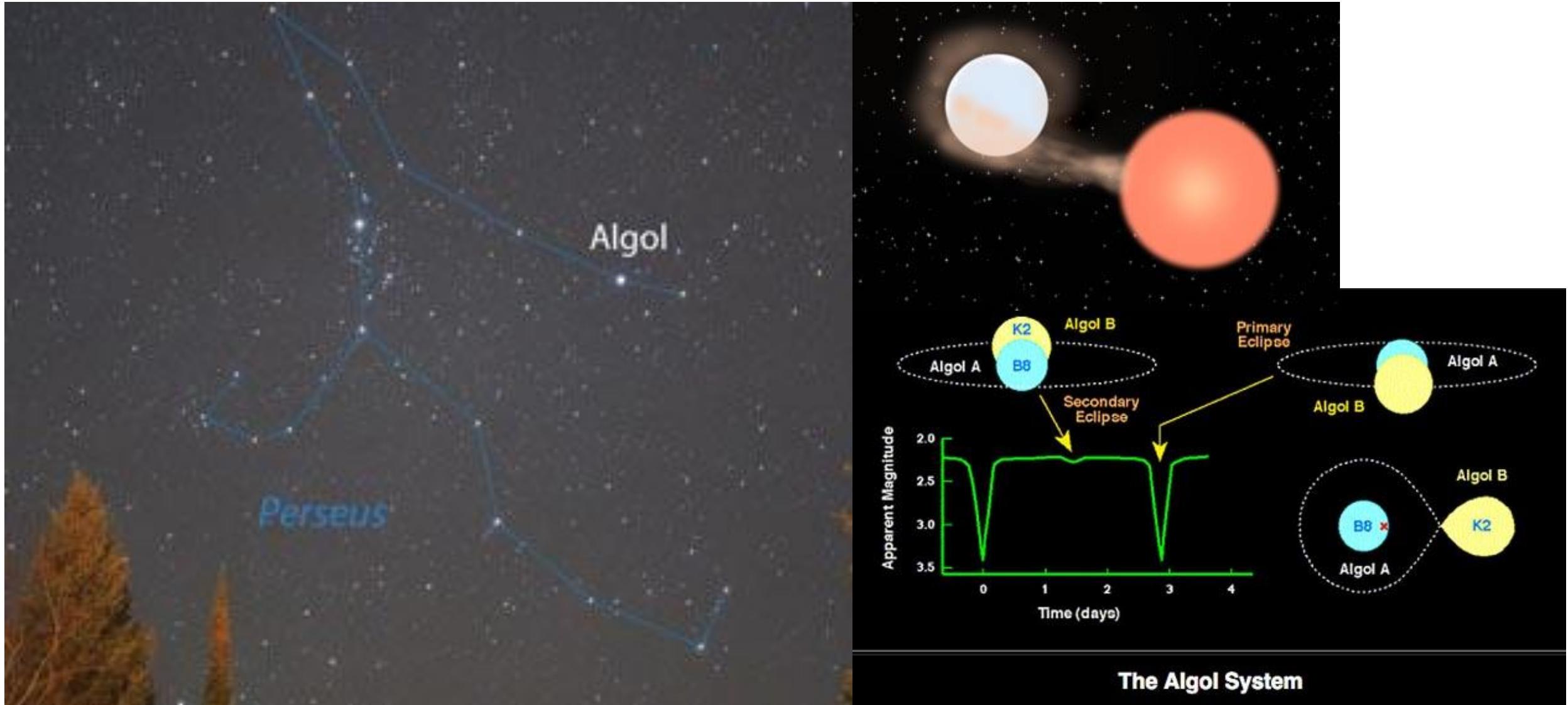
Variable stars are stars that vary in brightness.

There are many different kinds of variable stars.

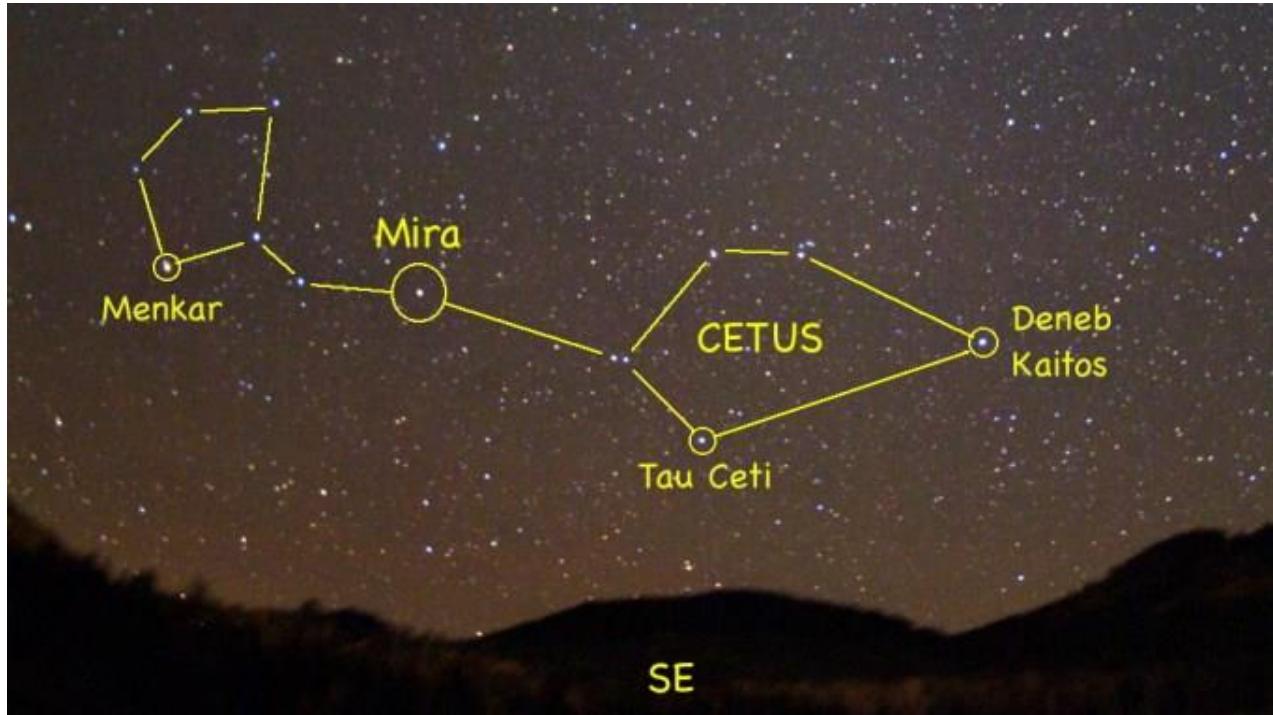
Over 450,000 variable stars have been catalogued, most of them within the last 10 years.



Algol – an eclipsing binary



Omicron Ceti (“Mira”) – Long Period Variable (LPV)



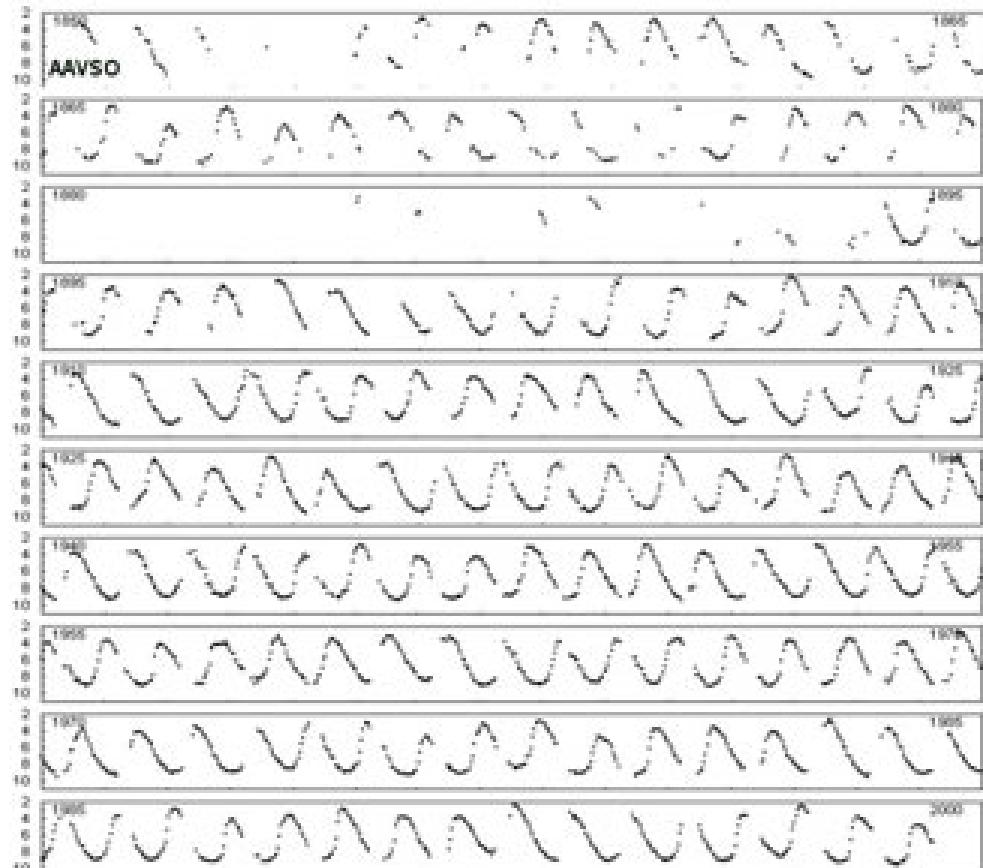
Range: 2.0 – 10.1
Period: 332 days



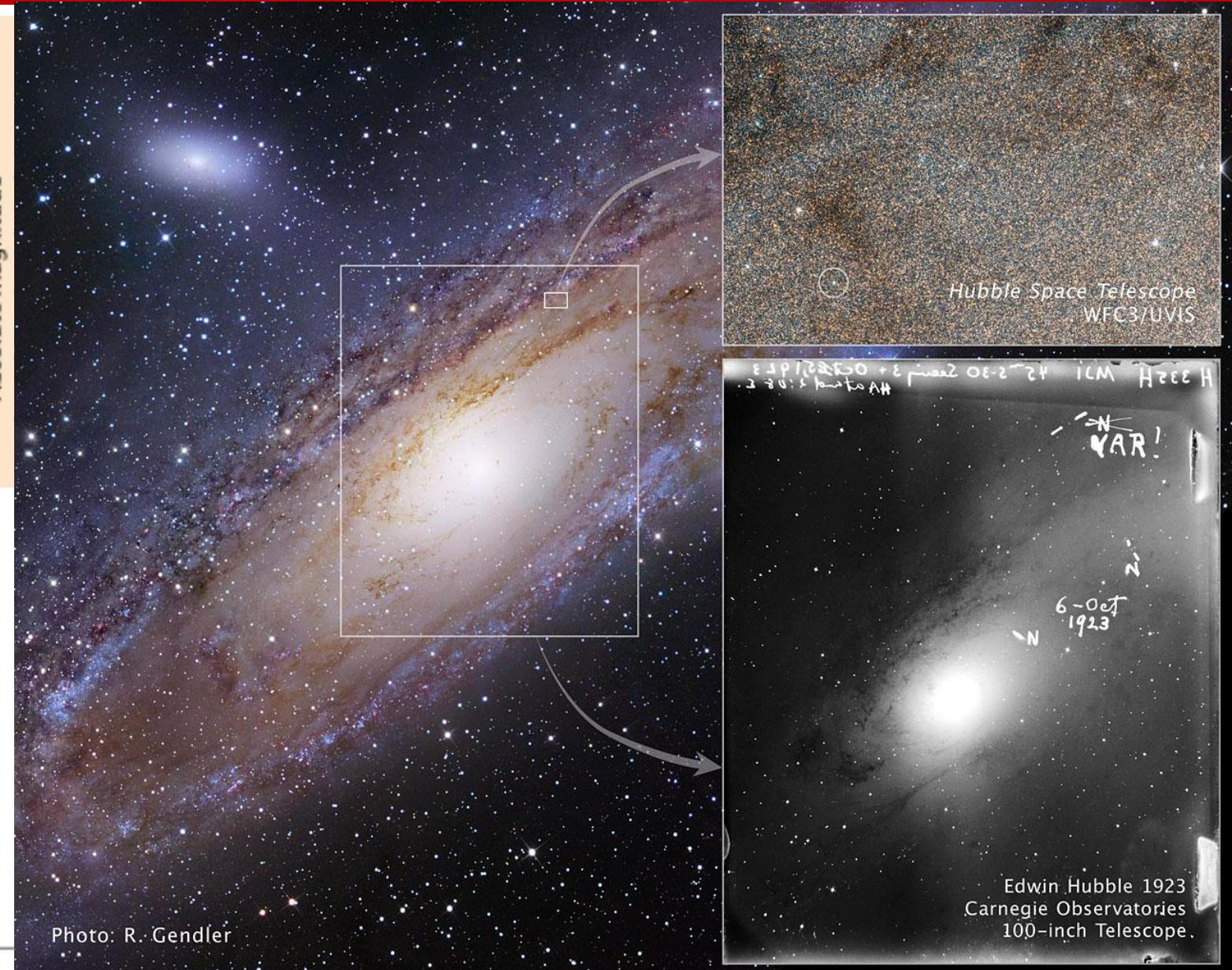
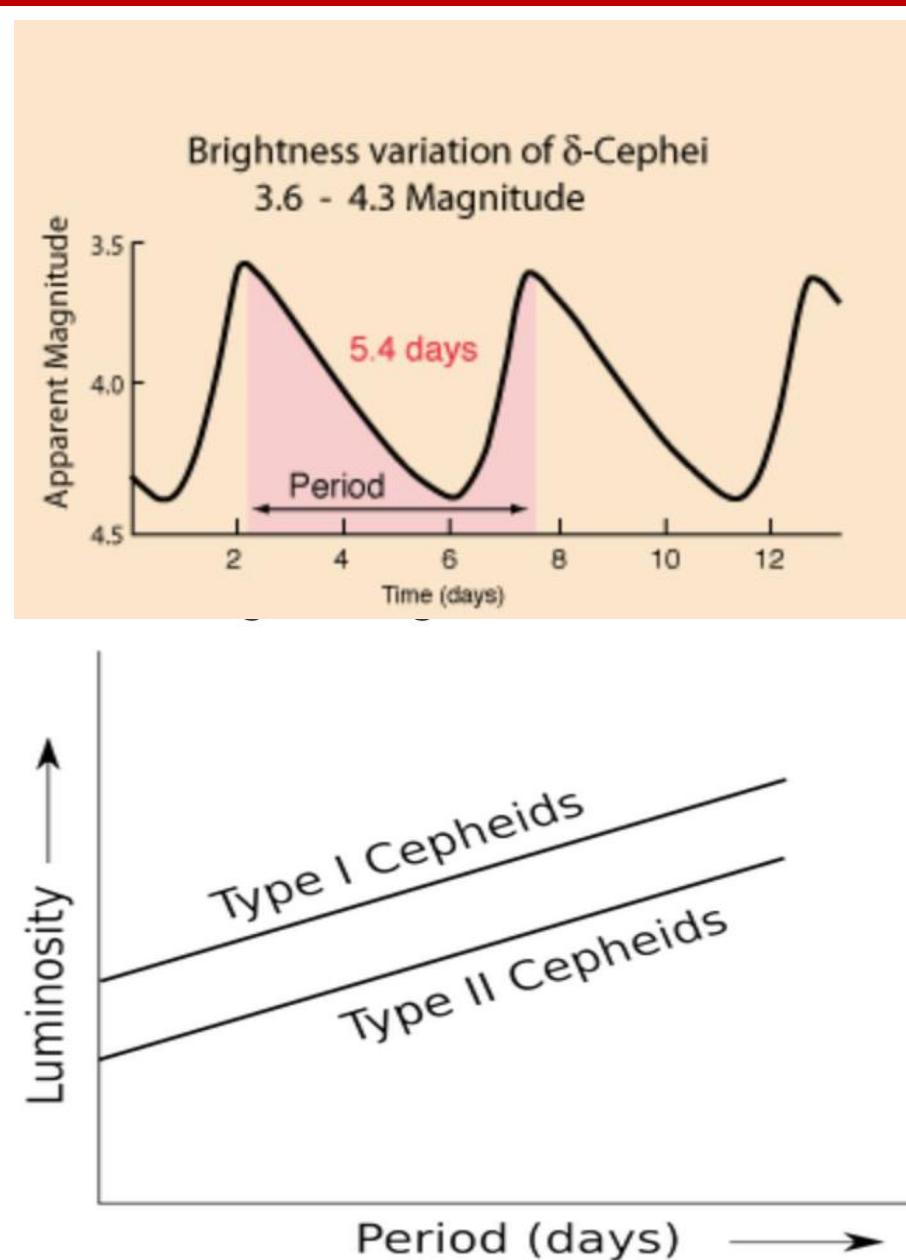
Mira (LPV) 1850-2000 (10-day means)

Mira (omicron Ceti) is the prototype of pulsating long period variables and the first star recognized to have changing brightness. It has a period of 332 days. Generally, Mira varies between magnitudes 3.5 and 9, but the individual maxima and minima may be much brighter or fainter than these mean values. Its large amplitude of variation and its brightness make Mira particularly easy to observe.

Mira is one of the few long period variables with a close companion which is also variable (VZ Cet).



Cepheid Variables – A Cosmic Yardstick



The AAVSO – www.aavso.org

The screenshot shows the AAVSO website with a dark background featuring a star field. At the top is a navigation bar with tabs: About Us, Community, Variable Stars, Observing, Data, and Getting Started. Below the navigation is the AAVSO logo and the text "American Association of Variable Star Observers". The main menu includes Home, Contact Us, FAQ, AAVSO Store, CCD School Videos, CHOICE Courses, and Donate, along with social media links for Facebook, Twitter, and RSS. On the left, there's a sidebar with the AAVSO logo and links for Our Mission, What We Do, and Get Involved. The central content area has sections for Information For (General Public, Observers, Researchers), Active forum topics (AAVSOnet status, Kilonova associated with GW170817), and JAAVSO (Journal of the American Association of Variable Star Observers). A large orange banner at the bottom right displays the number of observations in the database: 3 | 4 , 2 | 1 1 , 9 6 | 3 and Counting ...



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Last Observation Received:

14 sec ago by SET - Christopher Stephan (US)

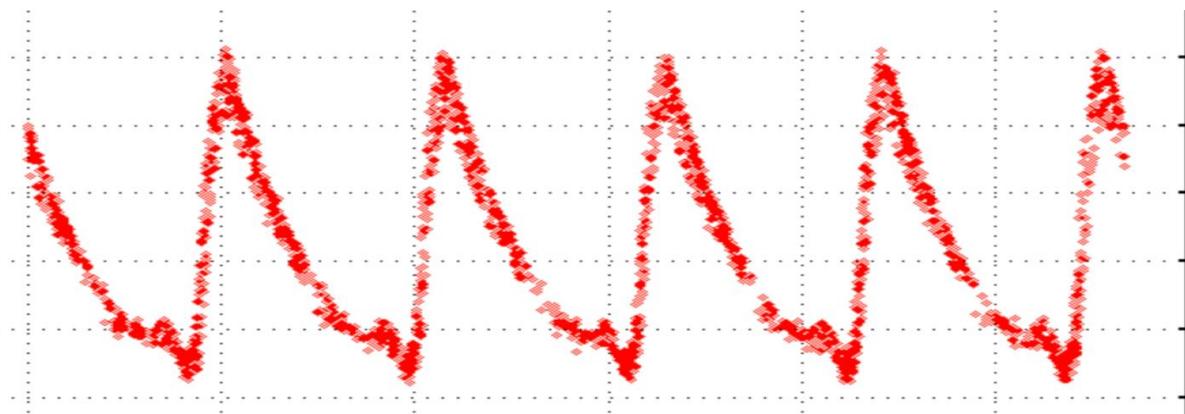
FZ DEL Oct 17.0361 10.0Vis.

Observing Variable Stars

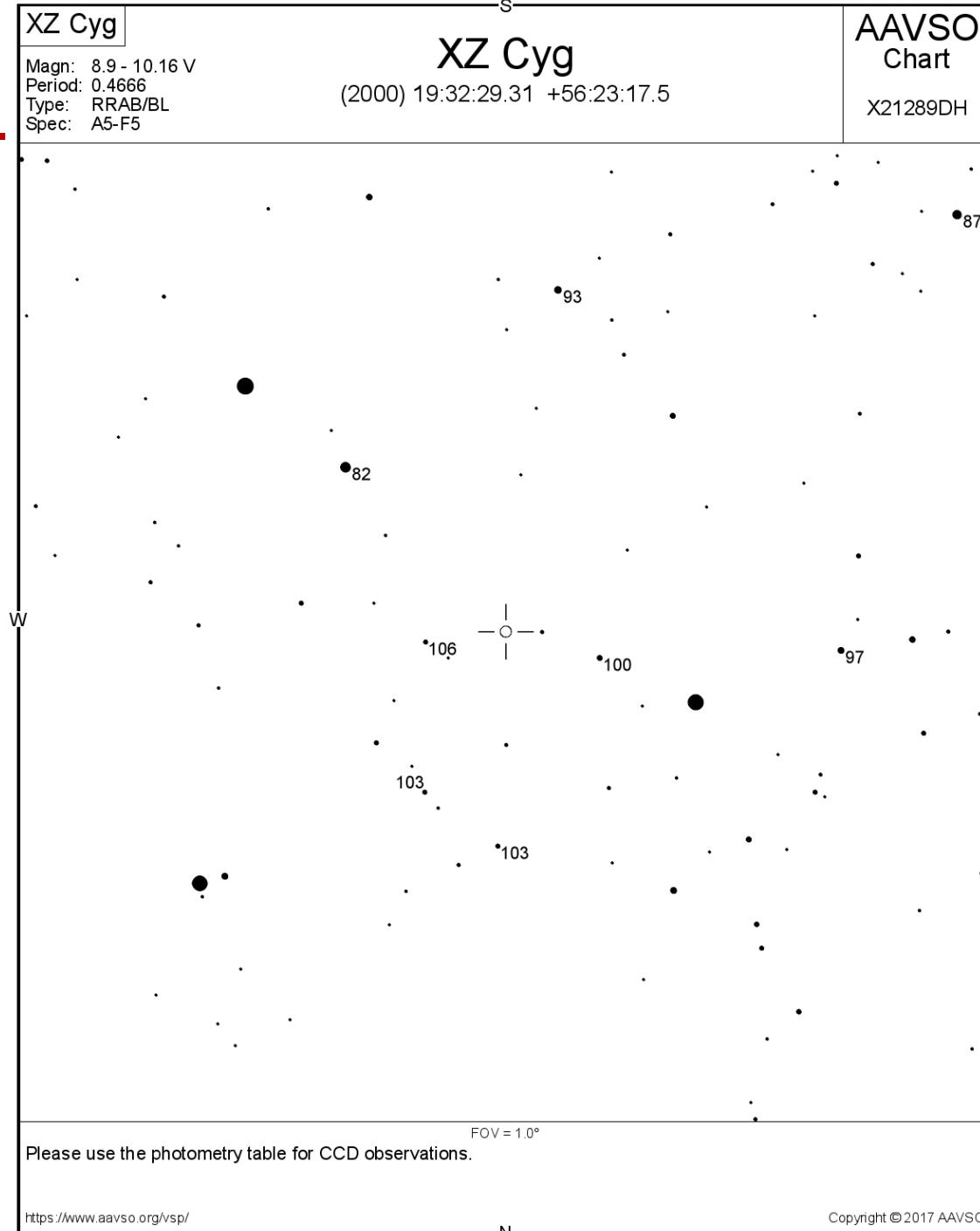
XZ Cygni is an RR Lyrae type star, that pulsates with a period of 11.2 hours.

Its brightness ranges from 8.7 to 10.4 magnitude.

It climbs from minimum to maximum in about one hour.

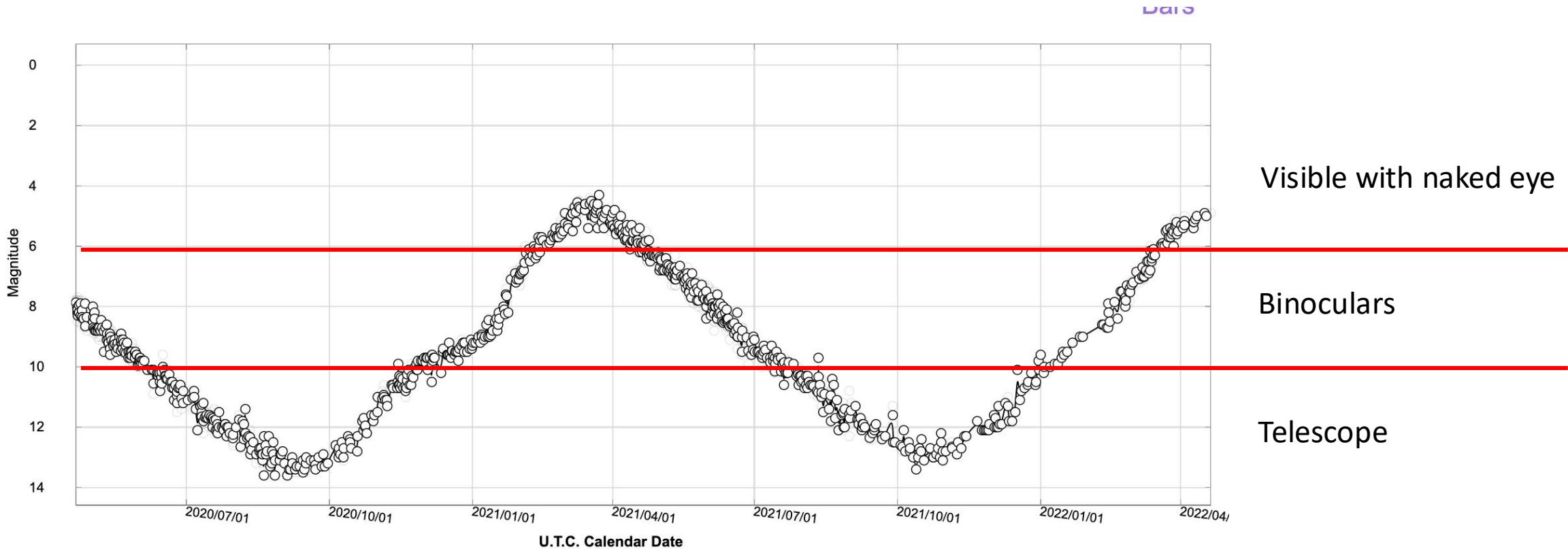


Northeastern University



Chi Cygni

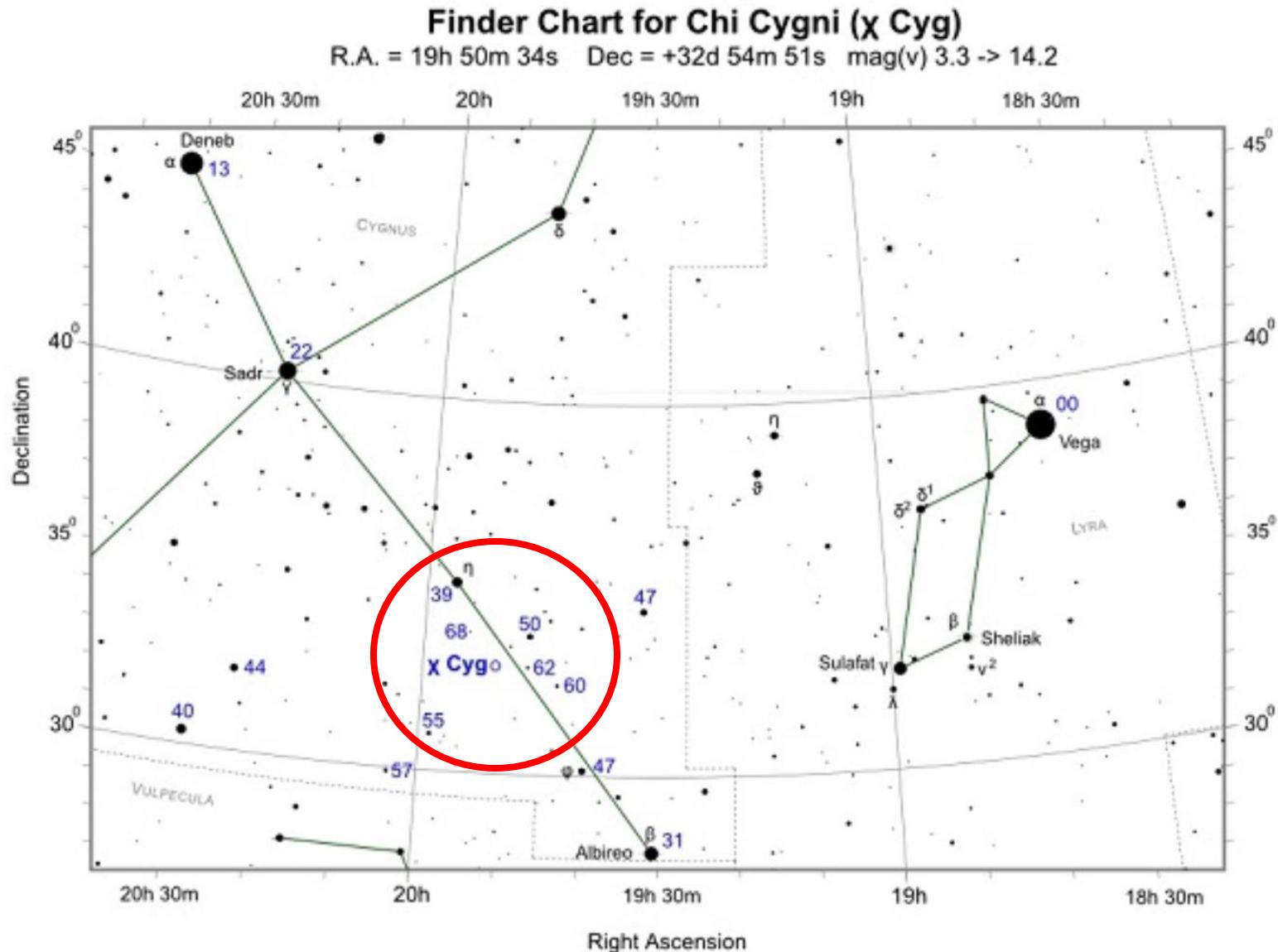
A luminous red giant nearing the end of its life.*



* Only 400 million years to go before it evolves into a white dwarf.



Finding Chi Cygni





Centre de Données astronomiques de Strasbourg

Strasbourg astronomical Data Center

[?](#) [B](#) [🔗](#)

Search Criteria

[Save in CDSportal](#)

Keywords

- B/vsx/vsx

Tables

- B/vsx
- ..vsx
- ..refs
- ..vsx_id

[Add](#)

[Choose](#)

Preferences

max: 50

HTML Table

All columns

Compute

- Distance ρ
- Position angle θ
- Distance (x,y)
- Galactic
- J2000
- B1950
- Ecl. J2000
- default

Sort by Distance

+ order -

No sort

Position in:

- Sexagesimal
- Decimal $^{\circ}$

Simple Target [List Of Targets](#)

Target Name (resolved by [Sesame](#)) or Position: J2000 Target dimension: 2 arcmin Radius Box size

[Fast Xmatch with large catalogs or Simbad](#)

B/vsx AAVSO International Variable Star Index VSX (Watson+, 2006-2014) [Post annotation](#)

[Similar Catalogs](#) [2006SASS...25..47W](#) [ReadMe+ftp](#)

1.B/vsx/vsx Variable Star indeX, Version 2017-10-16 (465200 rows)

Simple Constraint [List Of Constraints](#)

Query by [Constraints](#) applied on Columns (Output Order: + -)

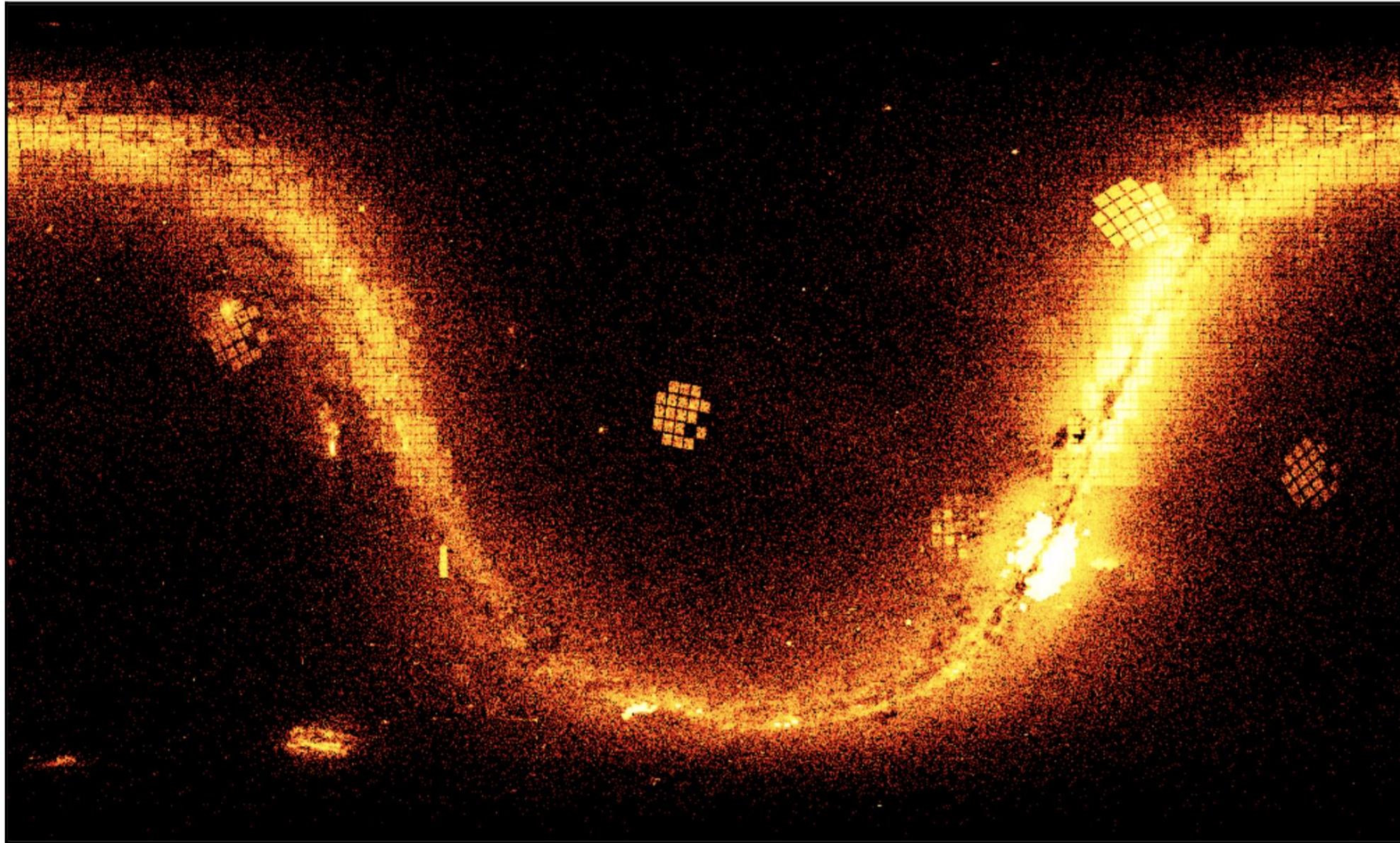
Show Sort Column Clear Constraint Explain (UCD)

<input type="checkbox"/>	<input type="radio"/> recno		Record number assigned by the VizieR team. Should Not be used for identification. (meta.record)
<input checked="" type="checkbox"/>	<input type="radio"/> OID		Internal identifier, can be used to link out to the VSX database (Note 1) (meta.id)
<input checked="" type="checkbox"/>	<input type="radio"/> n_OID	(char)	B indicates bibliography (in file " refs.dat "), V indicates an additional VSX name (in file vsx_id) (meta.ref.url)
<input checked="" type="checkbox"/>	<input type="radio"/> Name	(char)	Variable star identifier (meta.id:meta.main)
<input checked="" type="checkbox"/>	<input type="radio"/> V	[0,2]	Variability flag (Note 2) (meta.note)
<input checked="" type="checkbox"/>	<input type="radio"/> Type	(char)	Variability type (see details of VSX type list) (meta.note;src.var)
<input checked="" type="checkbox"/>	<input type="radio"/> l_max	(char)	Limit flag on max (meta.code.error)
<input checked="" type="checkbox"/>	<input type="radio"/> max	mag	(n) Magnitude at maximum, or amplitude (phot.mag)
<input checked="" type="checkbox"/>	<input type="radio"/> u_max	(char)	Uncertainty flag on max (meta.code.error)
<input checked="" type="checkbox"/>	<input type="radio"/> n_max	(char)	Passband on max magnitude (Note 4) (meta.note)
<input checked="" type="checkbox"/>	<input type="radio"/> f_min	(char)	[() '()' indicates an amplitude (meta.code)

[Reset All](#) [Clear](#) (n) indicates a possible blank or NULL column [Submit](#)

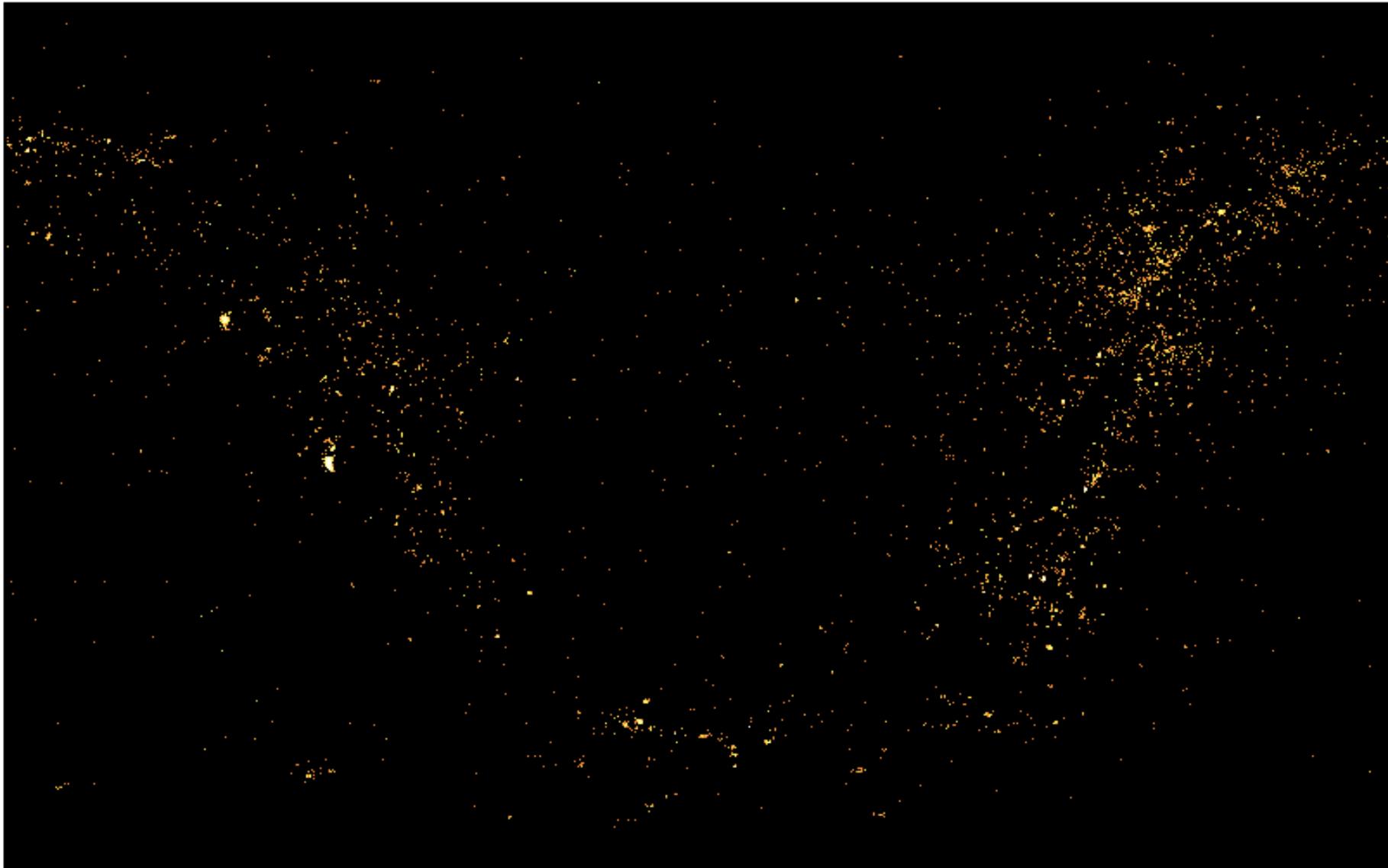


A Map of the AAVSO's VSX Catalog of 2.28 Million Variable Stars (July 2024 Data Release)

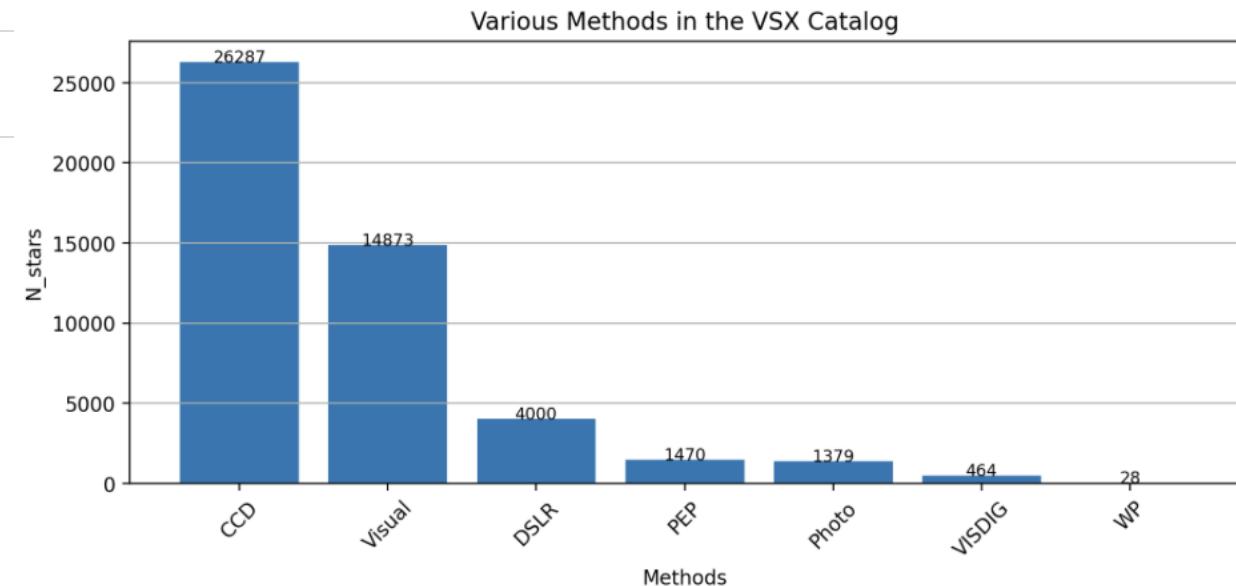
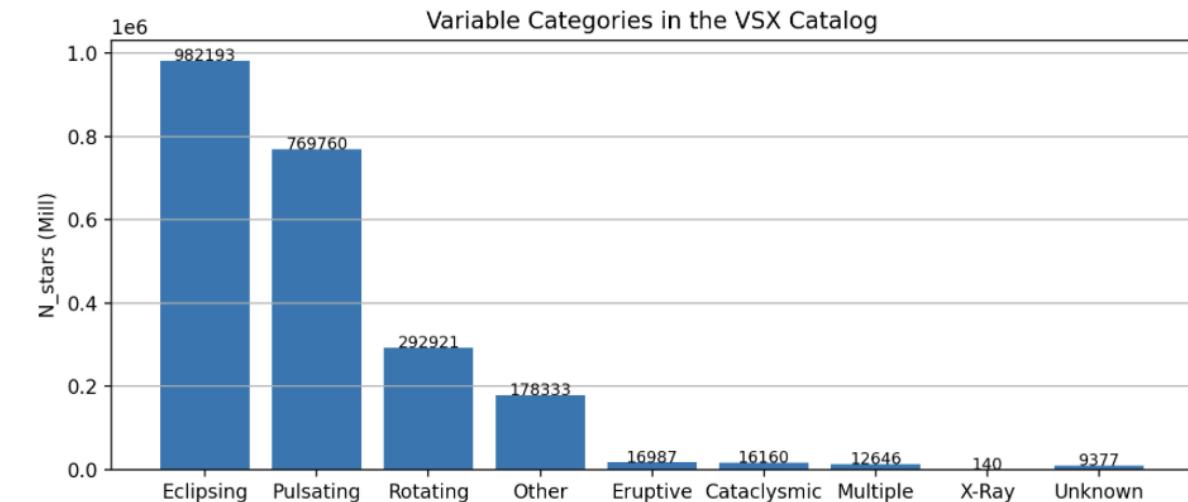
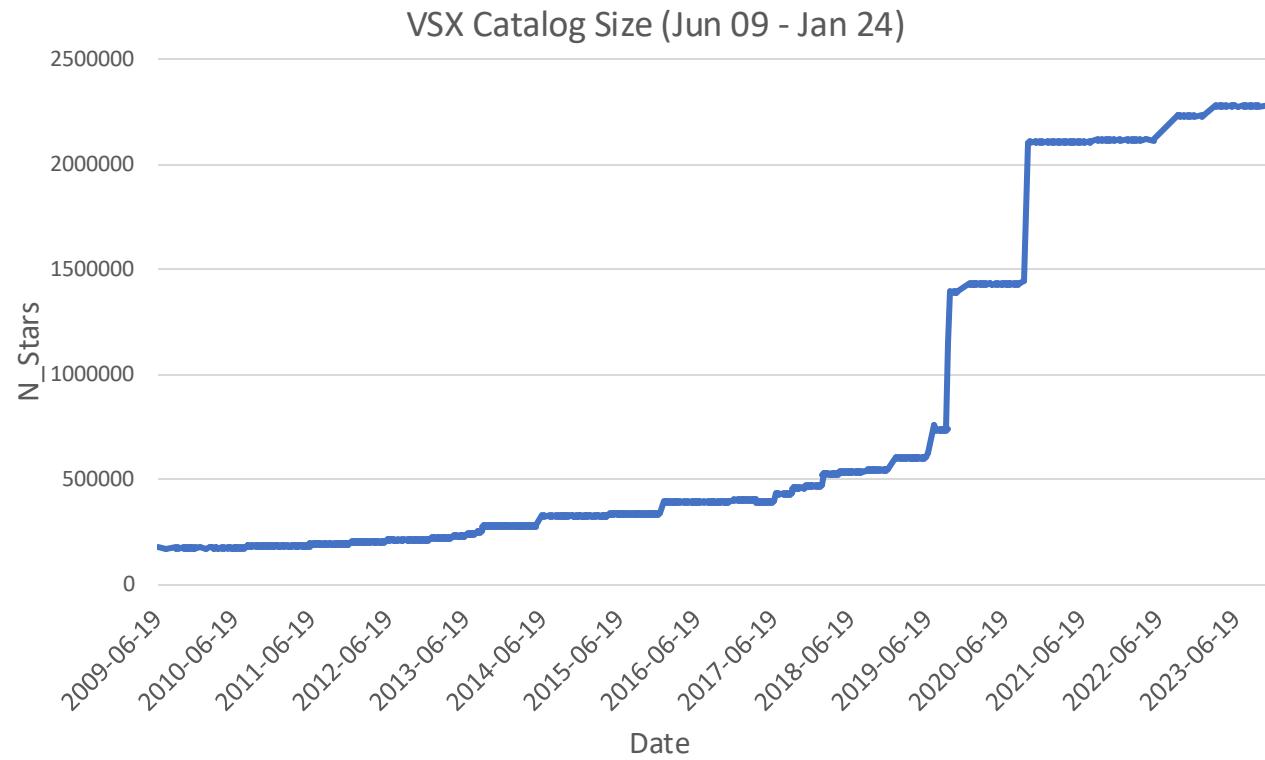


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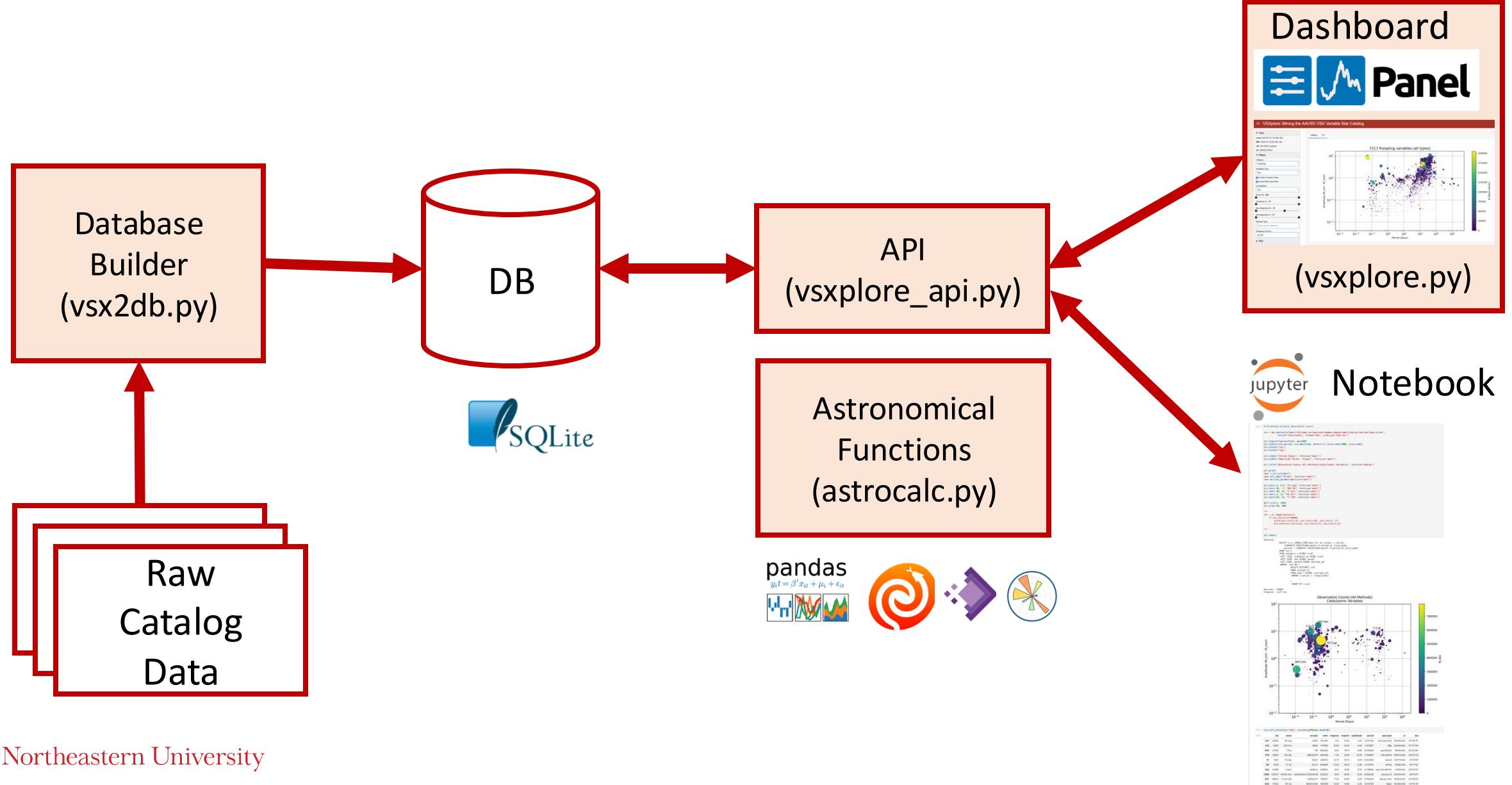
60 Million Observations of 32,000 Variable Stars



VSX Database Statistics



Platform Architecture



vsxplore_api.py: An API for the VSXplore Database

CURRENT API METHODS:

```
# Connect to the SQLite Database
connect(dbfile, debug=False)

# Execute A customized SQL Query against the database
execute(query, debug=False)

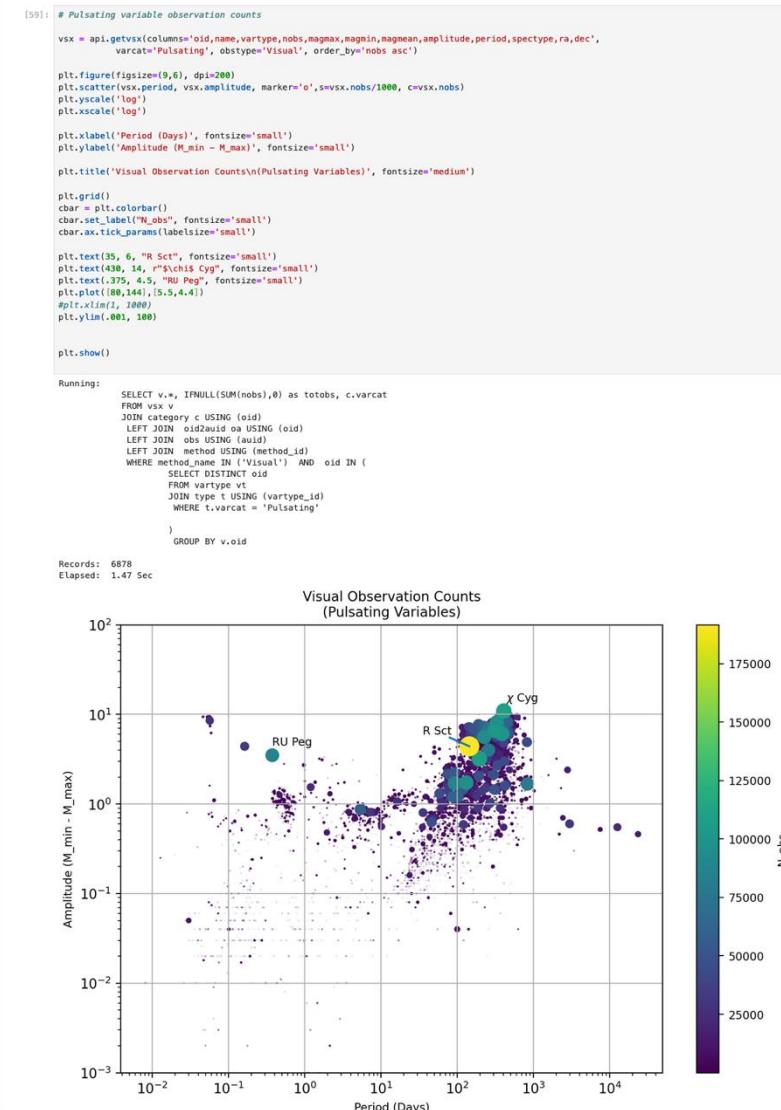
# Main vsx record selector
getvsx(columns='*', limit=0, order_by=None,
       varcat=None, vartype=None,
       period=None, amplitude=None,
       magmax=None, magmin=None, magmean=None,
       nobs=None, obstype=None, constellation=None,
       format=None,
       gps=None, above_horizon=None)

get_constellations() # full table of constellation data

get_constellation_list() # For pulldown constellation selector

get_variable_types() # Variability category --> [ list of variability types ]

get_variability_type_descriptions(oid): # Text descriptions of types linked to
                                         # a particular OID.
```



VSXplore Python Code

Program	Lines	Description	Libraries
vsxplore.py	572	The main VSXplore Dashboard	matplotlib, numpy, pandas, panel, datashader, colorcet
vsxplore_api.py	549	Converts widget settings into a SQL query and returns a DataFrame table of results	pandas, time, sqlite3
vsx2db.py	359	Builds an 886 Mb fully indexed variable star database (vsx.db) from raw CSV data including the VSX data release, supplemental table of variability types, and observation count data.	pandas, numpy, sqlite3, argparse, time, os
astrocalc.py	234	Miscellaneous astronomical functions used in API implementation.	datetime, math, astropy



Startup Screen (on Plot Tab)

≡ VSXplore: Mining the AAVSO VSX Variable Star Catalog

▼ Time

Local: 2024-08-03 05h 09m 59s
GMT: 2024-08-03 12h 09m 59s
LST: Set GPS Longitude
JD: 2460526.00694
MJD: 60525.50694

► Search

► Plot

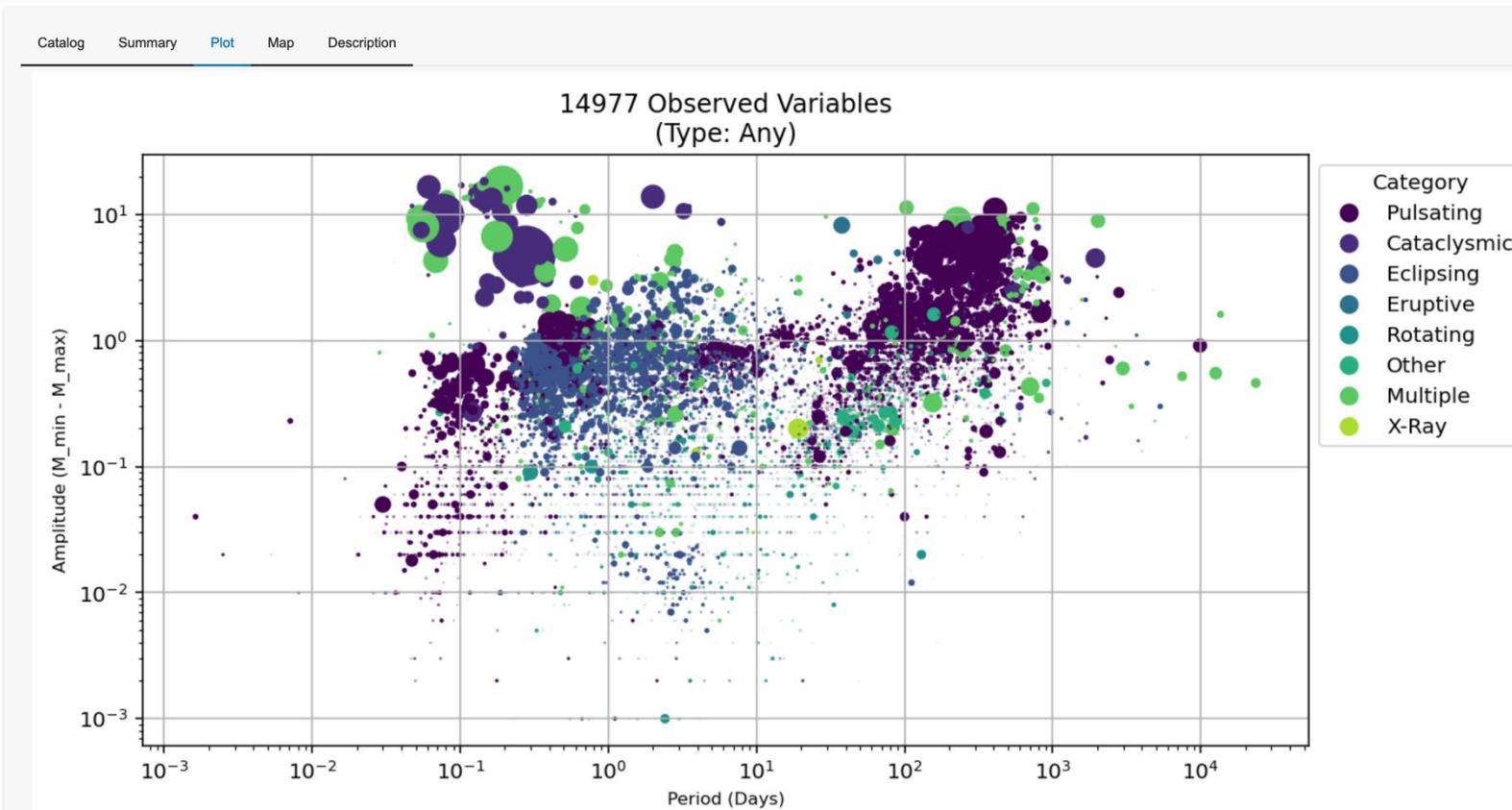
► Location

► About



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☰



Observed variables with $m_{\text{mean}} < 13.0$



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Catalog Tab

Catalog	Summary	Plot	Map	Description									
oid	name	con	varcat	vartype	nobs	magmax	magmin	magmean	amplitude	period	spectype	ra2000	dec2000
10,939	SS Cyg	Cyg	Cataclysmic	UGSS	787,283	7.7	12.4	10.05	4.7	0.27513	K5V+pec(UG)	21h42m43s	43°35'10"
5,083	AM CVn	CVn	Cataclysmic	IBWD	511,660	14.0	14.4	14.2	0.4	0.011907	DBp	12h34m55s	37°37'44"
608,515	V3721 Oph	Oph	X-Ray	LMXB/BHXB:/X	480,682	11.7	18.8	15.25	7.1	0.1417		18h20m22s	07°11'07"
27,184	T Pyx	Pyx	Cataclysmic	NR	380,382	6.2	16.1	11.15	9.9	0.076229	pec(NOVA)	09h04m42s	-32°22'48"
14,950	DQ Her	Her	Multiple	NB/DQ+EA	348,306	1.3	18.08	9.69	16.78	0.193621	WD+M3Ve	18h07m30s	45°51'33"
10,600	R CrB	CrB	Eruptive	RCB	333,824	5.61	15.1	10.355	9.49	-	C0,0(F8pep)	15h48m34s	28°09'24"
1,023	FO Aqr	Aqr	Multiple	DQ+E	284,012	12.7	15.7	14.2	3.0	0.202059	pec(e)	22h17m55s	-08°21'04"
3,709	TT Ari	Ari	Cataclysmic	NL/VY	242,656	10.2	16.5	13.35	6.3	0.137551	M3.5e	02h06m53s	15°17'42"
14,298	U Gem	Gem	Multiple	UGSS+E	206,975	8.2	14.9	11.55	6.7	0.176906	pec(UG)+M4.5V	07h55m05s	22°00'05"
133,572	V0455 And	And	Multiple	UGWZ/DQ+E+;	205,202	8.5	16.5	12.5	8.0	0.056309	pec(e)+L2	23h34m01s	39°21'41"
28,923	V1223 Sgr	Sgr	Cataclysmic	UG/DQ+VY	194,627	11.2	16.8	14.0	5.6	0.140244	pec(e+cont)	18h55m02s	-31°09'50"
34,117	R Sct	Sct	Pulsating	RVA	193,608	4.2	8.6	6.4	4.4	144.1	G0iae-K2p(M3)lbe	18h47m29s	-05°42'19"
17,555	HP Lib	Lib	Multiple	IBWD+ZZB:	190,408	13.55	13.8	13.675	0.25	0.012763	Bpec	15h35m53s	-14°13'12"
16	RX And	And	Cataclysmic	UGZ	189,543	10.3	14.8	12.55	4.5	0.209893	pec(UG)	01h04m36s	41°17'58"
16,400	VW Hyi	Hyi	Cataclysmic	UGSU	182,594	8.4	14.4	11.4	6.0	0.074271	WD+M4V	04h09m11s	-71°17'42"
10,971	XZ Cyg	Cyg	Pulsating	RRAB/BL	174,030	8.9	10.16	9.53	1.26	0.4666	A5-F5	19h32m29s	56°23'17"
37,141	UX UMa	UMa	Multiple	EA/WD+NL	173,581	12.57	14.15	13.36	1.58	0.196671	pec(e)	13h36m41s	51°54'49"
10,602	T CrB	CrB	Multiple	NR+ELL	171,978	2.0	10.8	6.4	8.8	227.55	M3III+pec(NOVA)	15h59m30s	25°55'13"
232,707	V0515 And	And	Cataclysmic	DQ	163,131	14.7	16.0	15.35	1.3	0.10935		00h55m20s	46°12'57"
132,667	OV Boo	Boo	Multiple	UGWZ+E+ZZ/C	162,892	11.2	20.6	15.9	9.4	0.046258	DAe+L	15h07m22s	52°30'40"

[First](#) [Prev](#) [1](#) [2](#) [3](#) [4](#) [5](#) [Next](#) [Last](#)

The catalog is sortable by any column and supports pagination. Here we have sorted by number of observations descending in order to identify the most observed variables.



Summary Tab

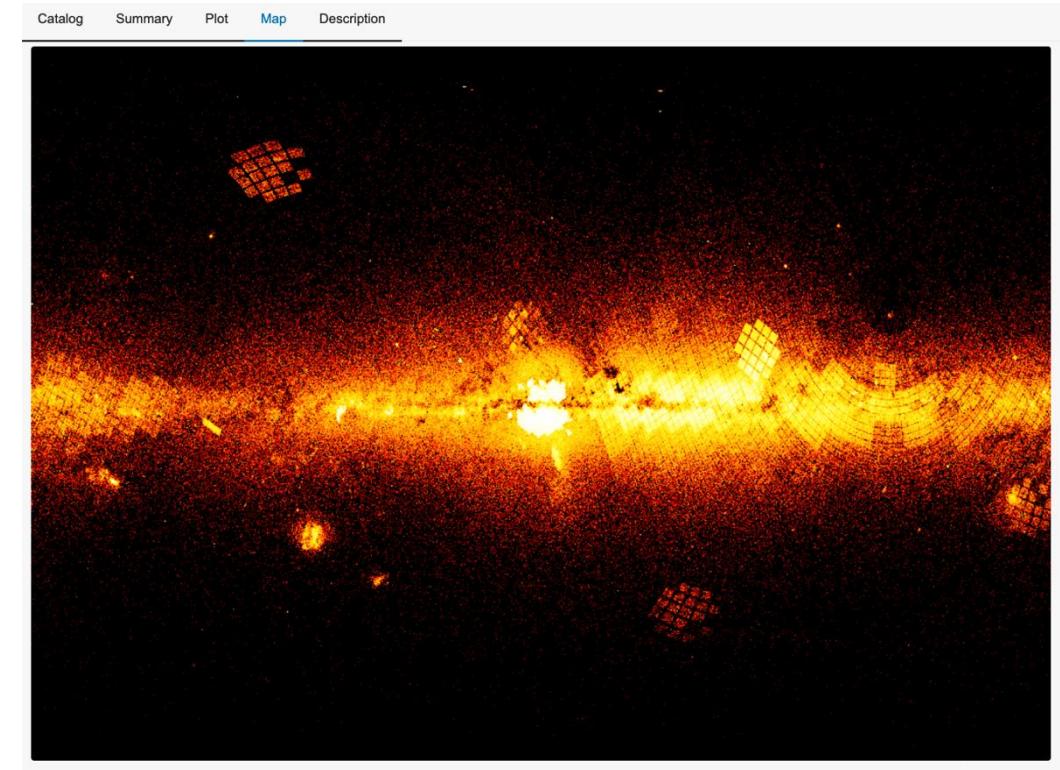
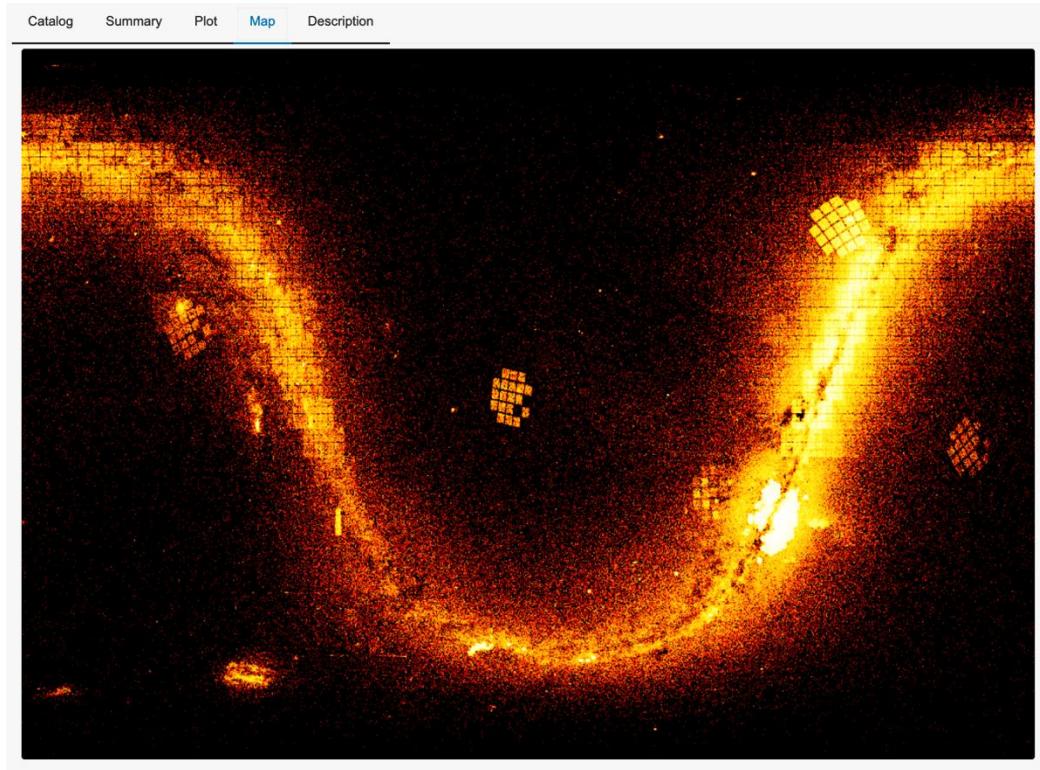
Catalog	Summary	Plot	Map	Description							
varcat	vtype	num	uncertain	nobs	nobs_max	period_min	period_avg	period_max	amplitude_min	amplitude_avg	amplitude_max
Pulsating	M	3,721	0.04	6,462,729	113,985	88.69	308.823373	1,650.0	0.3	4.11954	11.0
Eclipsing	EW	1,940	0.012	3,329,663	75,254	0.186359	0.408694	5.34	-0.77	0.41623	1.3
Eclipsing	EA	1,694	0.019	1,899,933	75,679	0.235	12.329074	9,442.4	0.002	0.678312	4.02
Pulsating	SRB	1,543	0.056	2,583,763	112,577	0.491043	147.701185	2,800.0	0.03	0.987824	5.4
Pulsating	LB	1,407	0.29	376,139	92,729	0.989712	133.897016	1,521.0	0.01	0.588869	4.9
Pulsating	SR	1,393	0.18	1,001,523	47,101	8.77963	178.450196	2,454.0	0.036	0.864156	7.2
Cataclysmic	UG	1,229	0.101	626,953	46,514	0.054892	3.518901	110.0	0.1	5.159935	10.7
Pulsating	RRAB	1,132	0.003	1,469,170	67,514	0.269624	0.55706	0.903966	0.104	0.968416	2.7
Cataclysmic	UGSU	918	0.07	2,845,863	182,594	0.032	2.783334	360.0	1.6	5.867328	9.6
Other	VAR	690	0.412	769,050	36,756	0.08412	19.998973	331.12583	0.001	0.451031	10.0
Eclipsing	EA/SD	577	0.215	1,041,572	132,537	0.4335	2.720591	12.942766	0.12	1.55799	4.3
Other	MISC	565	0.0	439,056	34,177	0.066823	106.62936	4,018.0	0.04	0.376512	2.845
Eclipsing	EB	520	0.065	671,301	34,239	0.289282	2.966632	423.0	0.04	0.44948	1.7
Other	CST	508	0.132	473,009	71,087	344.0	344.0	344.0	0.01	0.598824	1.6
Pulsating	SRA	483	0.033	513,503	50,968	37.2	238.582901	730.0	0.2	1.80228	6.3
Pulsating	DCEP	428	0.002	649,761	63,270	0.833911	10.209591	127.447	0.14	0.845928	2.4
Rotating	BY	385	0.164	261,521	49,290	0.187621	11.151226	617.6	0.005	0.128862	2.11
Pulsating	L	382	0.191	629,054	50,324	22.25	162.78858	721.0	0.02	0.530185	2.8
Pulsating	DSCT	370	0.076	600,003	55,649	0.016648	0.10781	0.277486	0.002	0.107556	1.2
Eruptive	IN	322	0.106	153,783	16,555	-	-	-	0.01	0.999875	5.0

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The summary table counts stars by each unique variable type, sorted initially by the number of matching stars of that type. The summary shows the fraction of stars that are uncertain, the number of observations as well as period/amplitude min, average, and max.



Map Tab



The “map” is an experimental visualization using Holoviz DataShader.
You can toggle between equatorial and galactic coordinates.
Support for Mollweide projections will be added in the future.



Description Tab (for selected types)

Catalog Summary Plot Map **Description**

Category: Pulsating

Type : DCEP

These are the classical Cepheids, or δ Cephei-type variables. Comparatively young objects that have left the main sequence and evolved into the instability strip of the Hertzsprung-Russell (H-R) diagram, they obey the well-known Cepheid period-luminosity relation and belong to the young disk population. DCEP stars are present in open clusters. They display a certain relation between the shapes of their light curves and their periods. They are fundamental mode pulsators.



User GPS Location

▼ Location

GPS Latitude (-90.0 ... 90.0)

33.60587

GPS Longitude (-180.0 ... 180.0)

-111.7293

▼ Time

Local: 2024-07-15 18h 14m 37s

GMT: 2024-07-16 01h 14m 37s

LST: 13h 25m 13s



JD: 2460507.55182

- Users may enter their GPS latitude and longitude in the Location panel.
- If provided, the longitude is used to compute Local Sidereal Time (LST)
- Latitude might be used in the future for filtering on stars above the horizon.
- All times are automatically updated once every second.



Search Panel

▼ Search

Name

Category

Variability Type
 BY
 CBSS
 CBSS/V
 CEP
 CST
 CTTS
 CTTS/ROT
 CV
 CW
 CW-FO
 OGLE

Include Uncertain Types
 Include Multi-Type Stars
 Include Unobserved Stars

Constellation

Period (10^x Days): -3 .. 5

Amplitude: 0 .. 10

Max Magnitude: 0 .. 15

Min Magnitude: 0 .. 15

Mean Magnitude: 0 .. 15

Spectral Type

- The **Search Panel** allows users to find matching stars int the VSX catalog
- Search by name, category, type, constellation, spectral type.
Indicate whether to include stars with an uncertainty and/or stars that have multiple type annotations (UGSS+ZZ) and/or stars that have no observations.
- The constellation for every star has been computed. Observers might want to limit their search by constellation if that constellation is high above the horizon.
- Specify a range of period, amplitude, max/min/mean magnitude.
When lower/upper bound is selected it means “or less” / “or greater” respectively



Plot Panel

▼ Plot

Show Grid

Marker Color

varcat

Color Map

viridis

Marker Size

nobs

Marker Scaling: 0

Marker Alpha: 1

X Axis

period

Log Scaling Reverse

Y Axis

amplitude

Log Scaling Reverse

Map Coordinates

RA/DEC (Equatorial)

- Matching variable stars are plotted as a scatter plot.
- Markers can be optionally color coded by **# observations (nobs), category, type, period, amplitude, declination, magmax, magmin, magmean**.
- The color map is user-selectable. Many options are color-blind accessible.
- The marker size can be optionally tied to one of the above attributes, and the size can be scaled for added clarity. A sizing legend will be added in the future.
- Users can specify both the X and Y axis attribute to be plotted: **nobs, period, amplitude, magmax, magmean, ra, dec, glat, glon** (galactic latitude / longitude).
- One or both axes can be log-scaled and/or reversed. Log scaling / reversing is ignored when plotting a coordinate value on a given axis.

About Panel

▼ About



VSXplore

Data Source

Data Release: 01-Jul-2024

Number of Stars: 2,279,174

[CDS Link](#)

Development Team

[John Rachlin](#)

Diya Jhamtani

Jeremiah Payeur

[RISE2024 Poster](#)

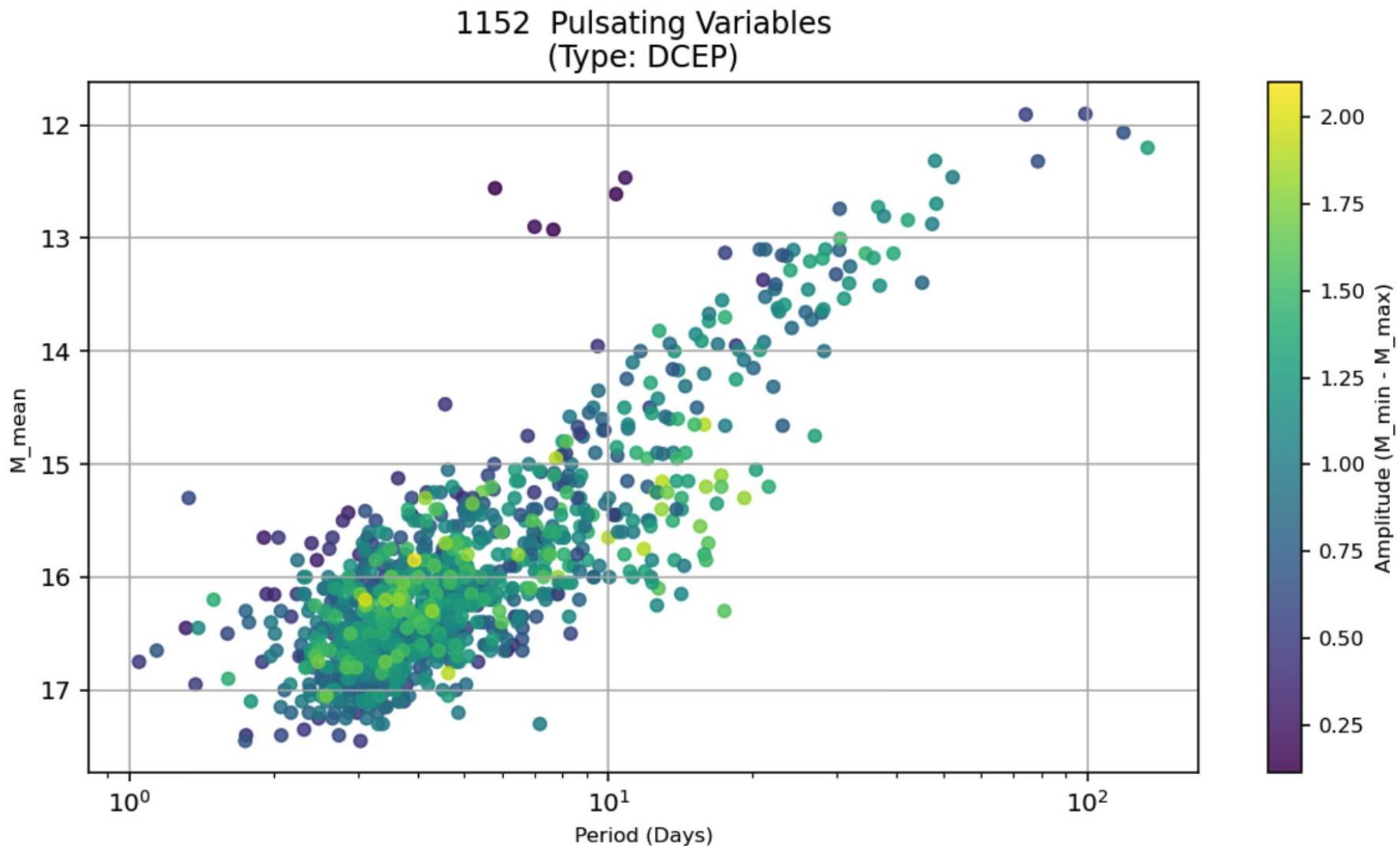
The About panel has information about the current database build and a CDS link identifying from where the data was retrieved.

Diya and Jeremiah presented their work at Northeastern University's annual RISE event which showcases many student research projects. (Poster attached separately.)

VSXplore Demonstration



Delta-Cepheid (DCEP) Variables in the LMC



Cepheids and Galactic Structure

492

THE ASTRONOMICAL JOURNAL

63, No. 1265

CEPHEIDS AND GALACTIC STRUCTURE

By SIDNEY VAN DEN BERGH

Perkins Observatory, Ohio State and Ohio Wesleyan Universities, Delaware, Ohio*

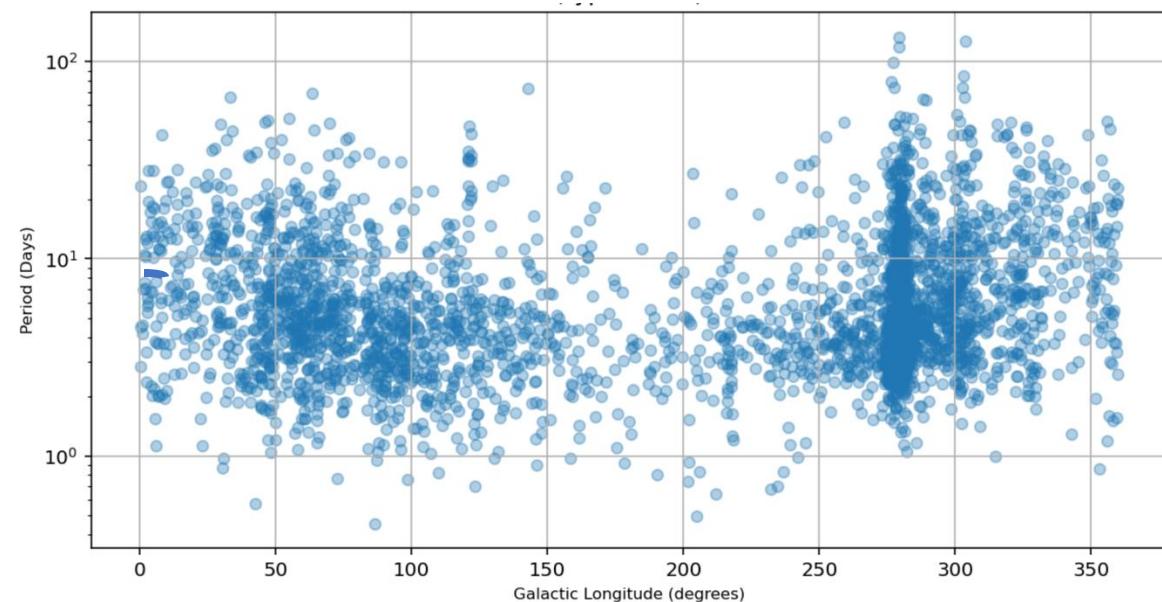
Received August 6, 1958

Abstract: The distribution of Cepheids with different periods within the galaxy is investigated. It is found that the space distribution of Cepheids with periods of 2 and 3 days differs significantly from that of Cepheids with periods of 7 and 8 days. Part of this difference is probably due to local variations of the rate of star formation with time. The Cepheids with the shortest periods predominate in the region between 10 and 12 kpc from the galactic nucleus. In this respect the galaxy is similar to the Magellanic Clouds in which the Cepheids with the shortest periods also predominate in the outer regions.

It is shown that the abundance of heavy elements in the interstellar gas depends on the ratio of the mass of interstellar gas to the total mass of gas and stars and is a function of distance from the nucleus of a galaxy. It is tentatively suggested that the dependence of Cepheid periods on distance from the nucleus may be due to the radial variation of the abundance of heavy elements in the interstellar gas from which the Cepheids are created.

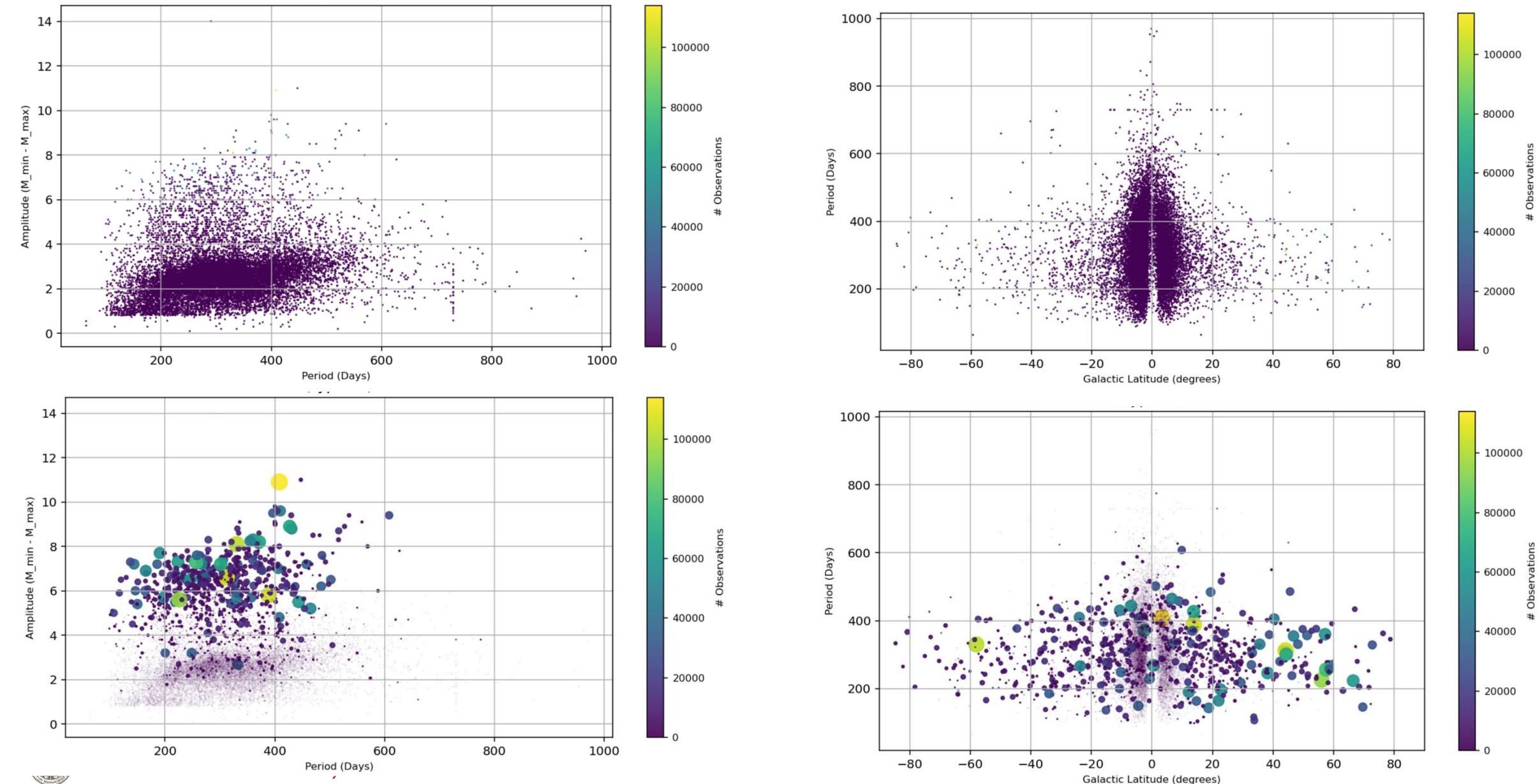
"[The] galaxy is similar to the Magellanic Clouds in which the Cepheids with the shortest periods also predominate in the outer regions."

van den Bergh (1958)

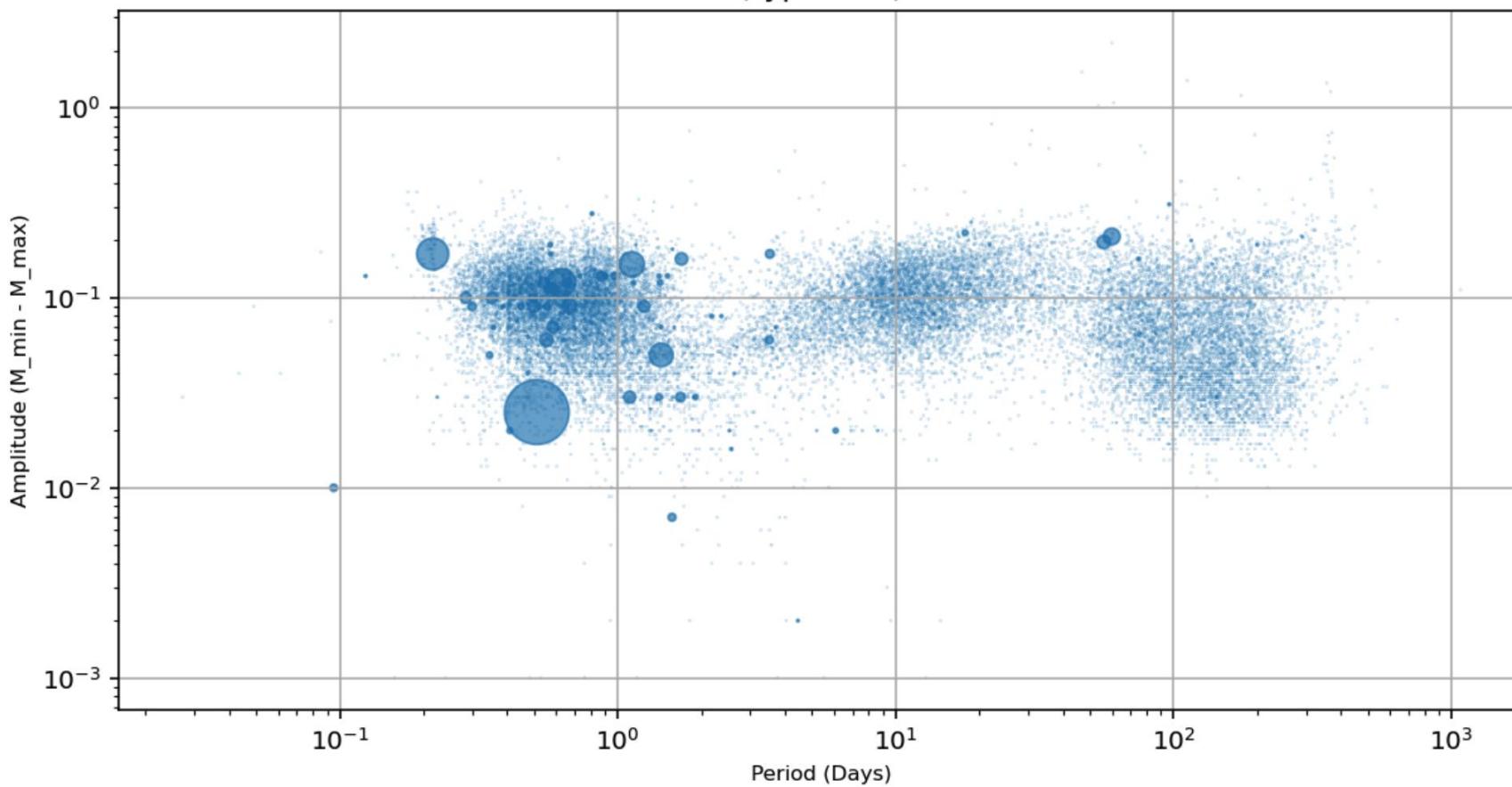


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15,005 Pulsating Variables (Type M)



25769 Rotating Variables (Type: ELL)



Category: Rotating

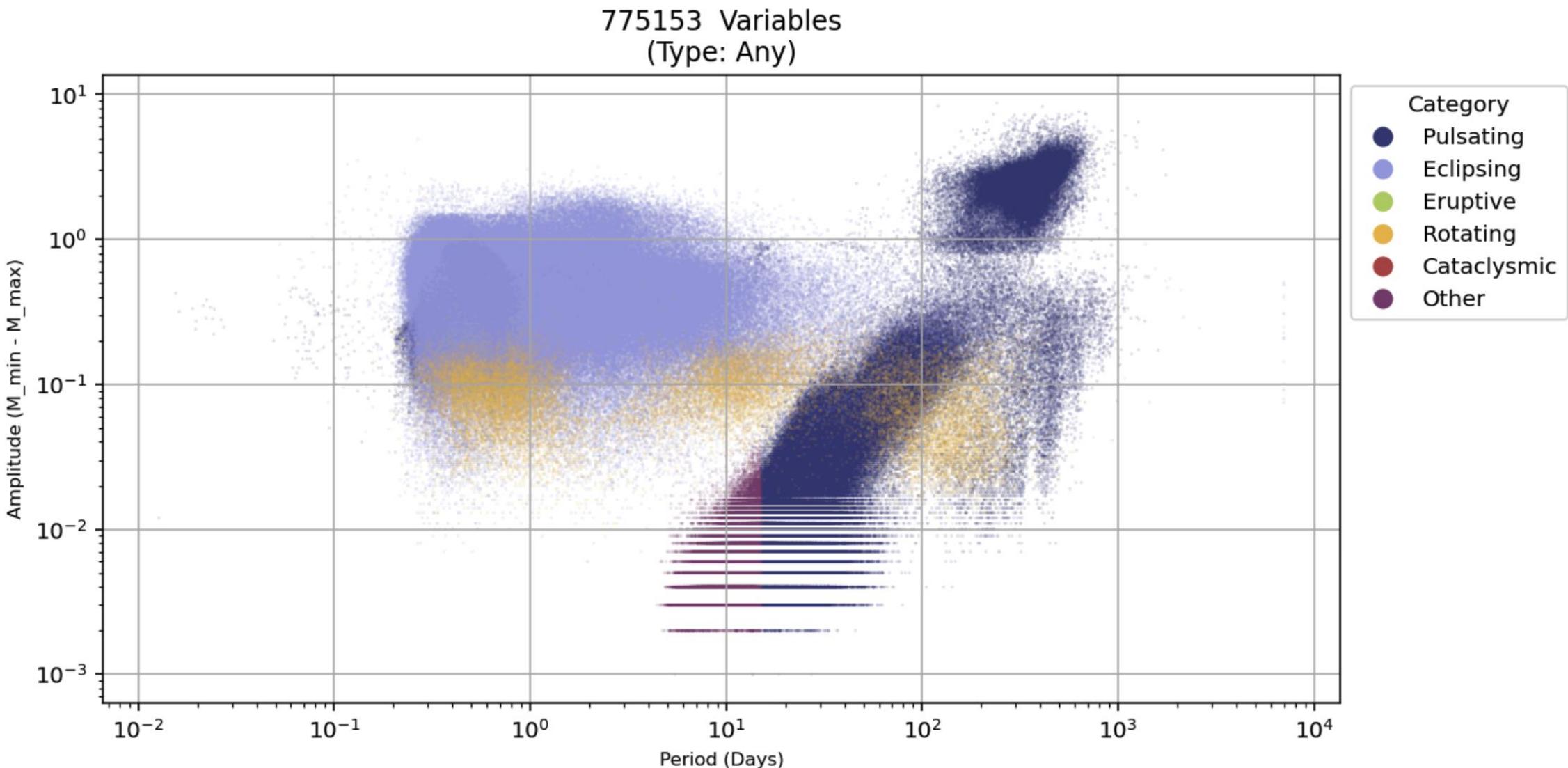
Type : ELL

Rotating ellipsoidal variables. These are close binary systems with ellipsoidal components, which change combined brightnesses with periods equal to those of orbital motion because of changes in emitting areas toward an observer.

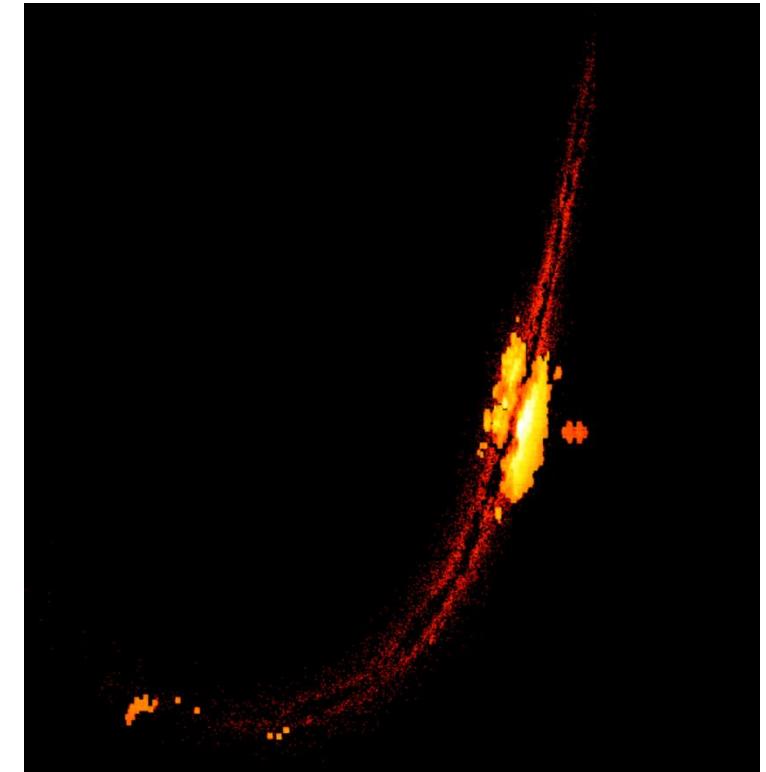
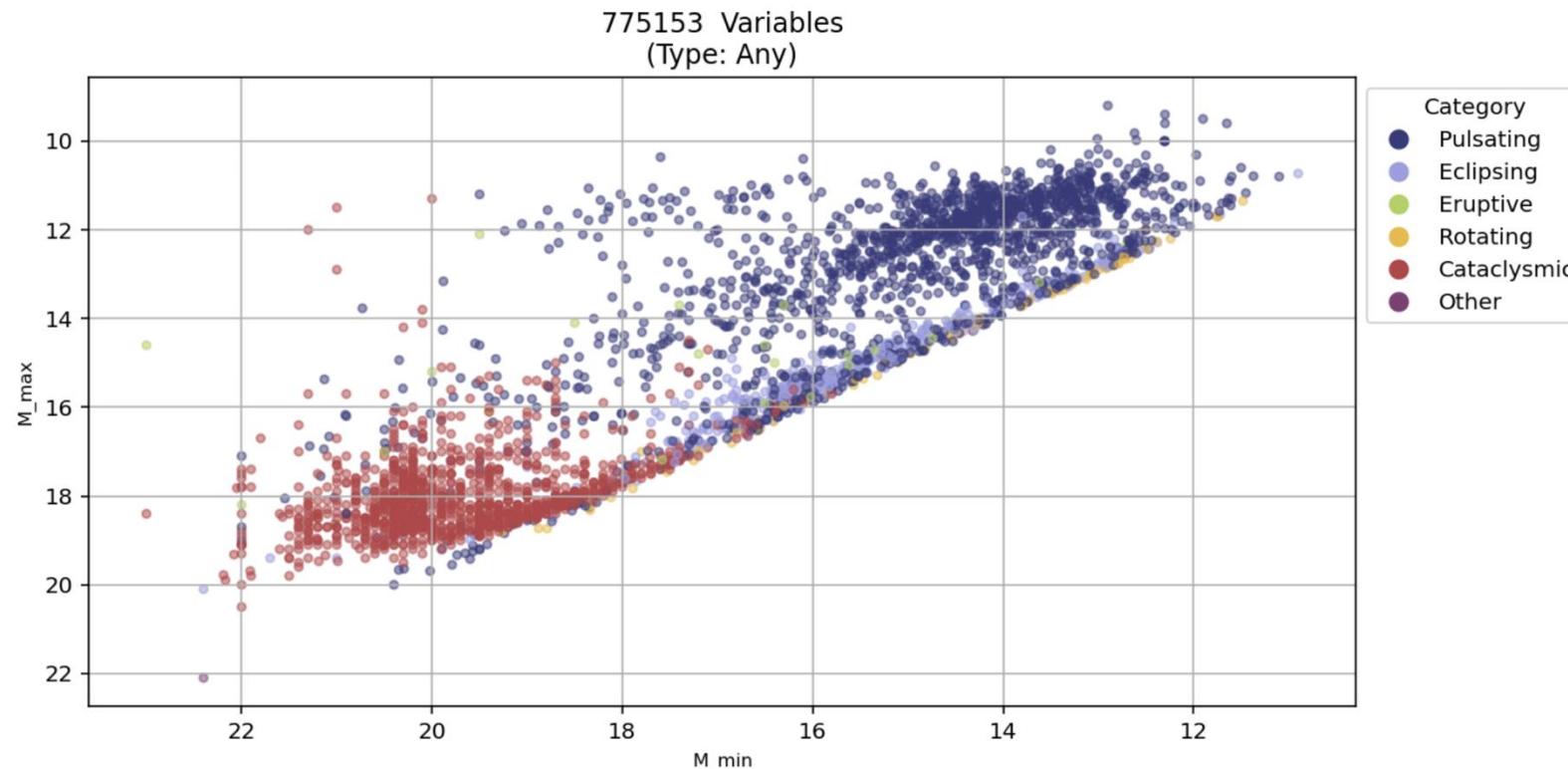
Eclipsing binaries may also show ellipsoidal variability but the ELL objects listed in VSX are those showing no eclipses. Light amplitudes usually do not exceed 0.1 mag. in V but may reach 0.3 mag. in some cases.



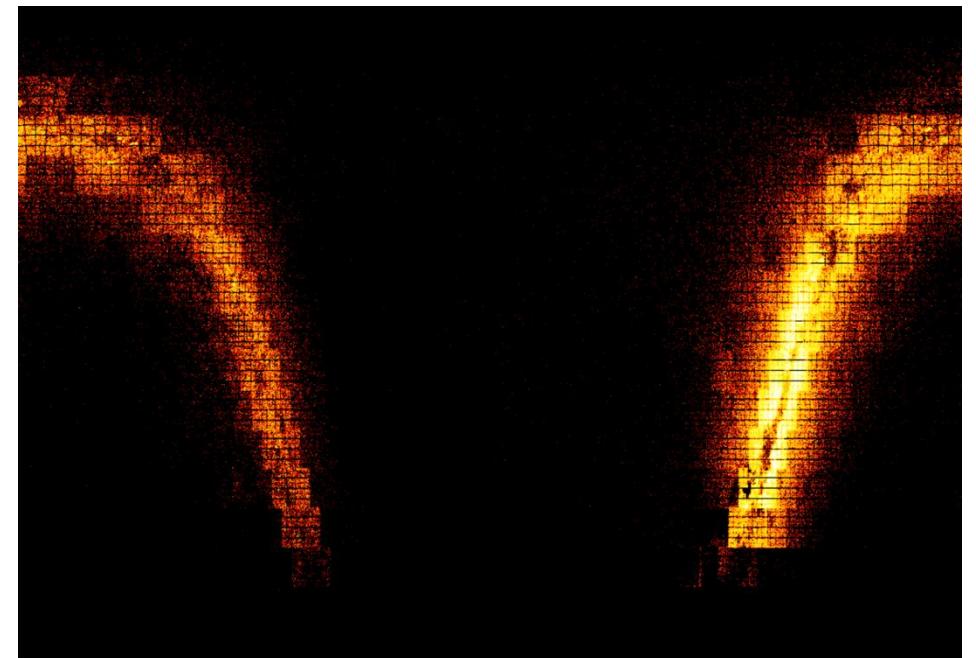
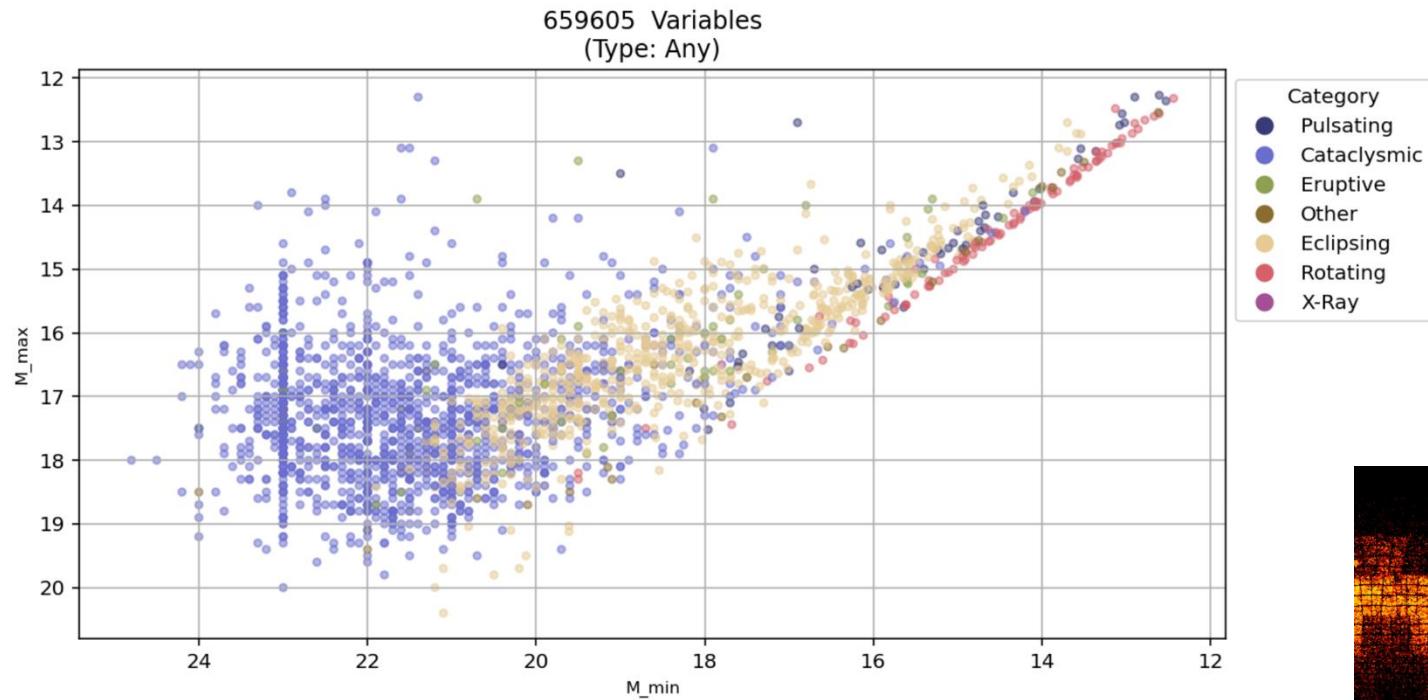
Optical Gravitational Lensing Experiment (OGLE)



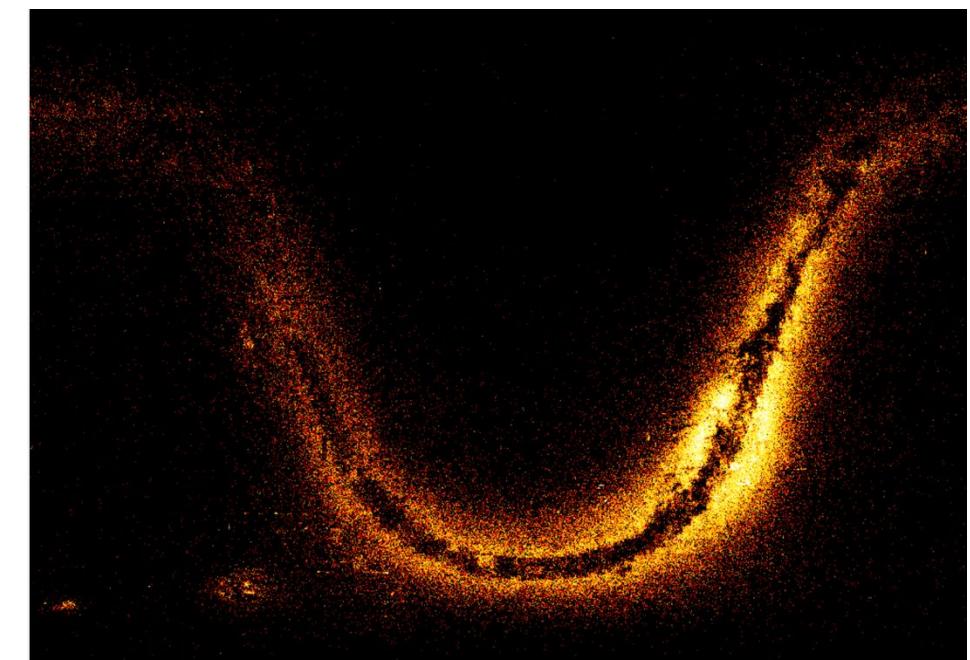
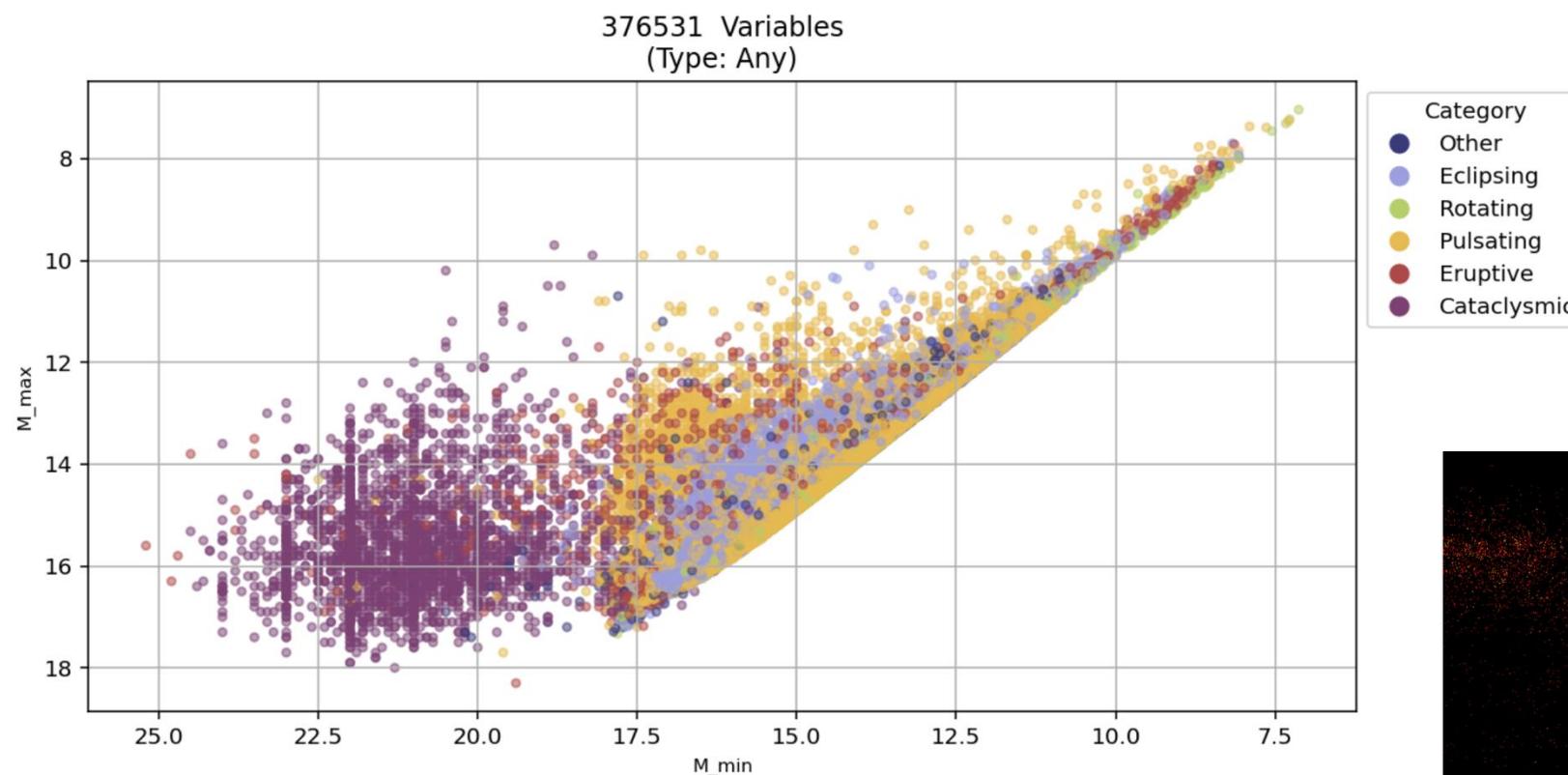
Optical Gravitational Lensing Experiment (OGLE)



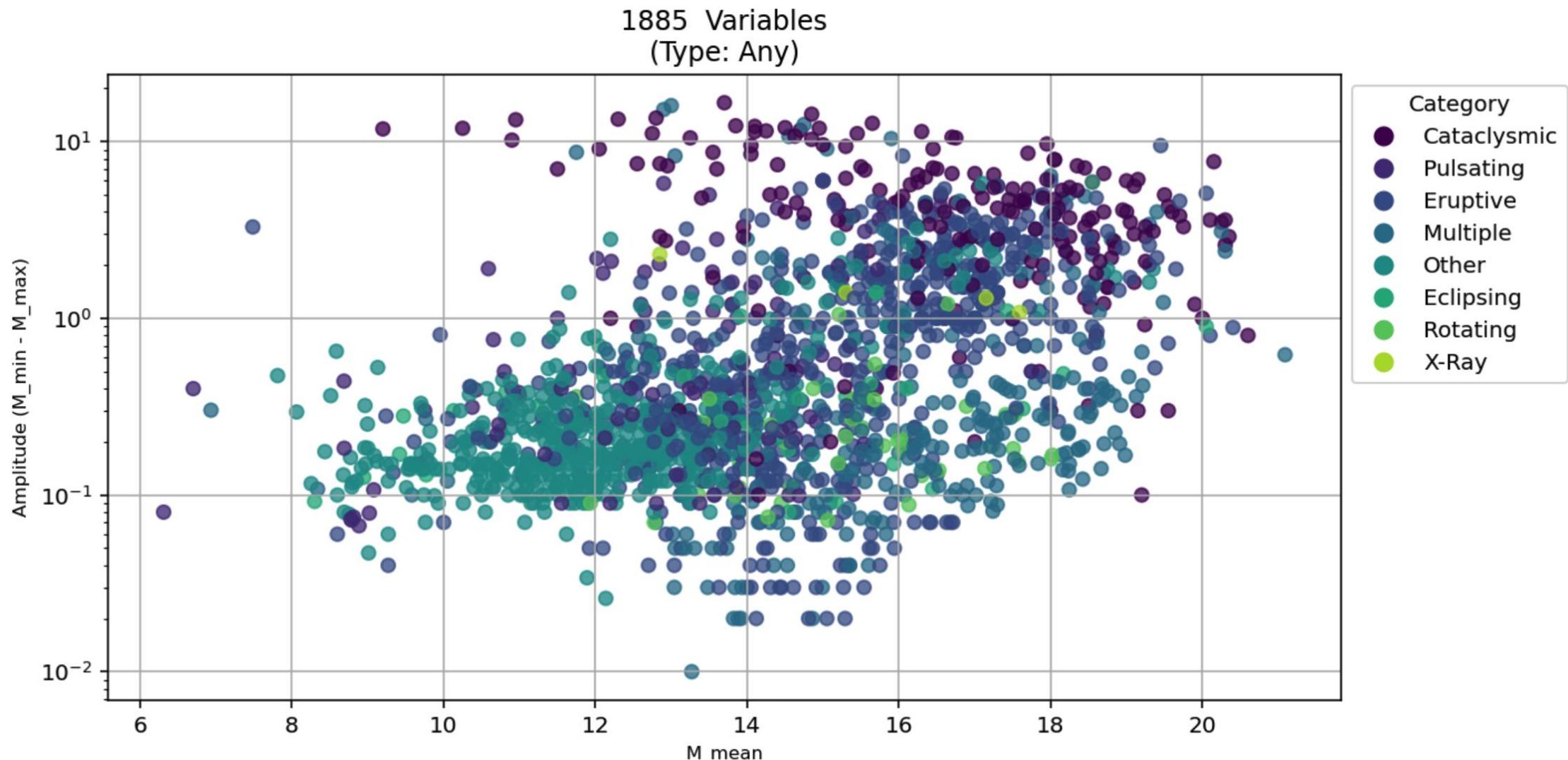
Zwicky Transient Facility (ZTF)



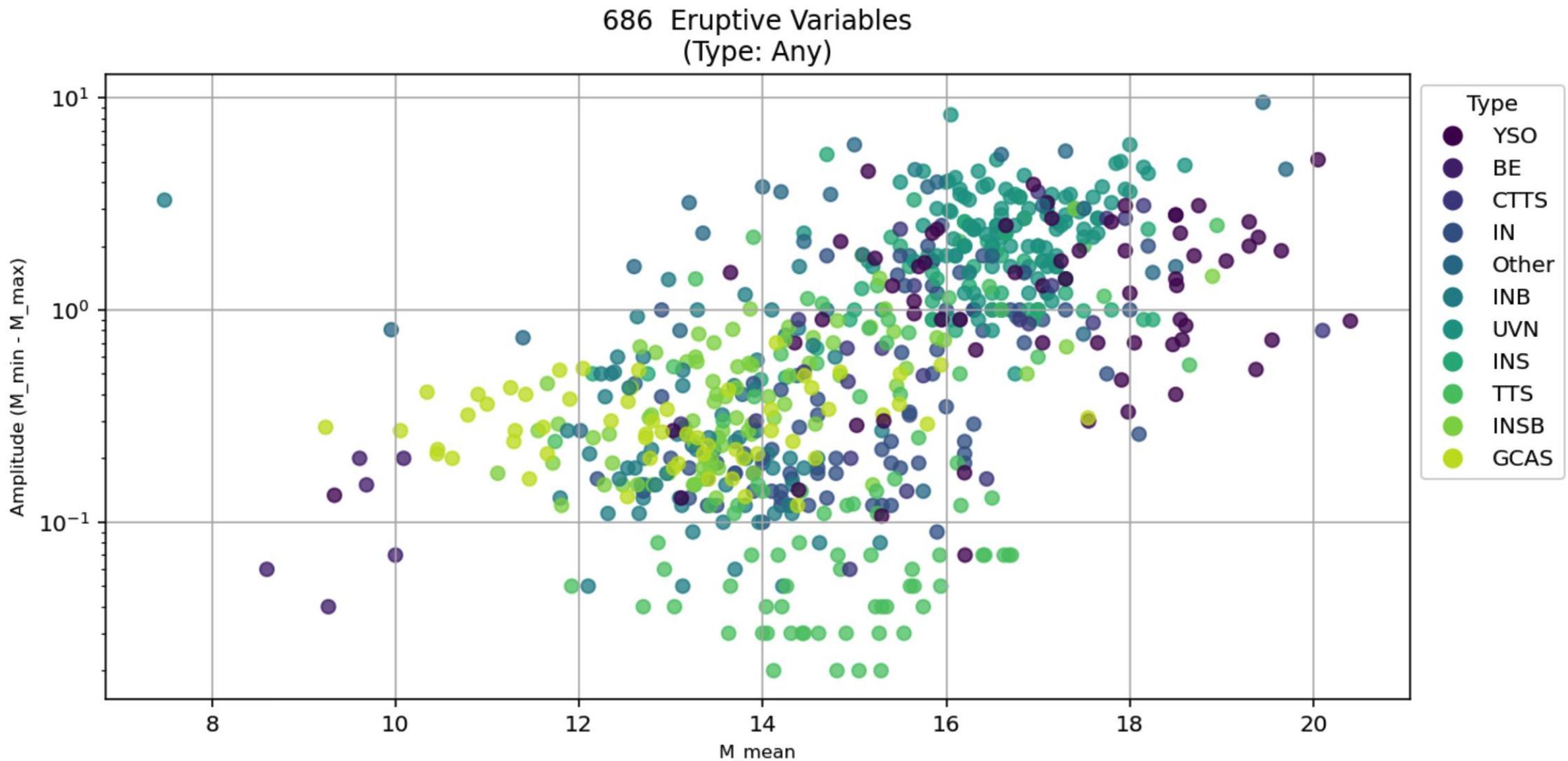
All Sky Automated Survey (ASAS)



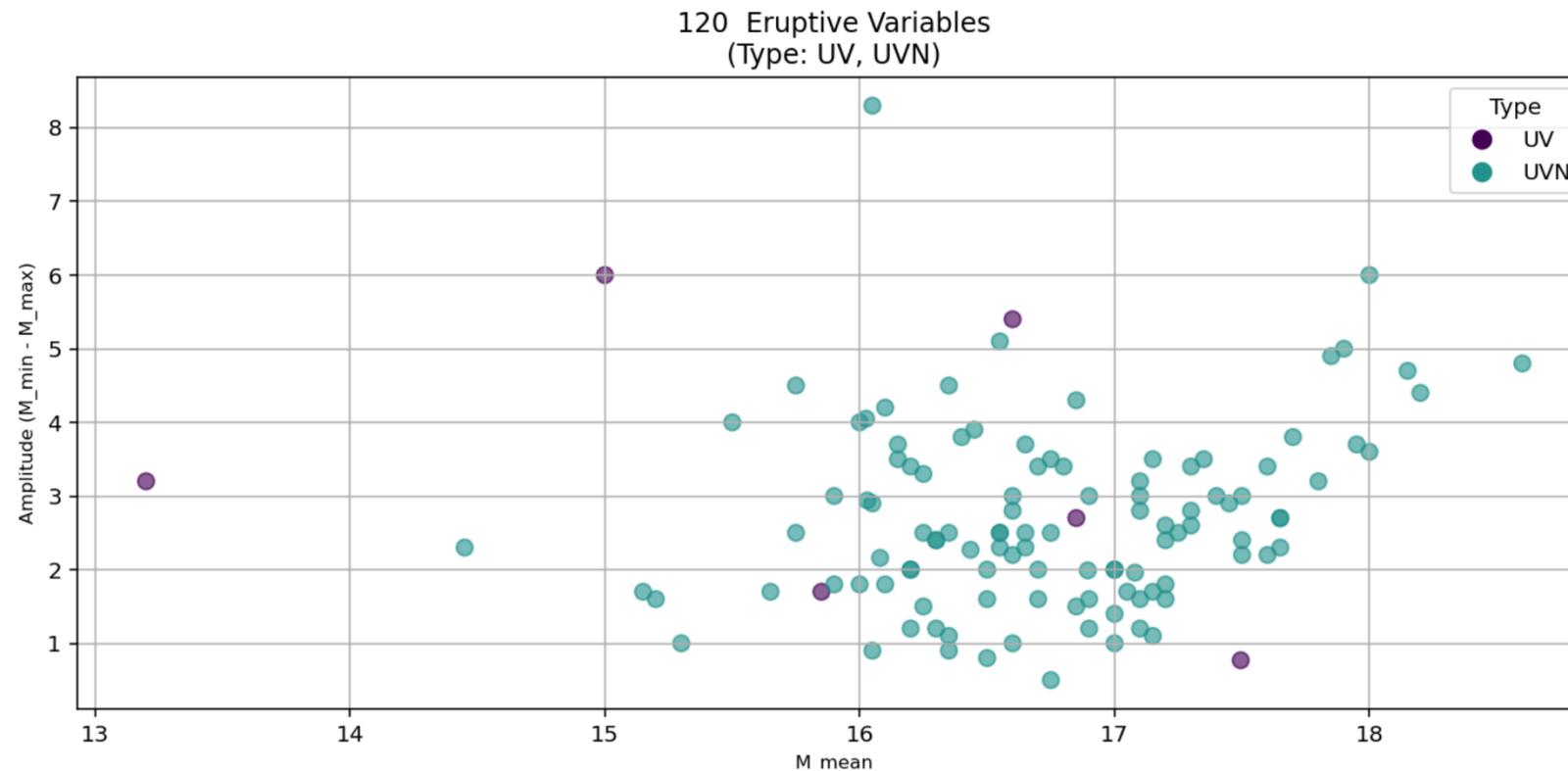
Variables with em spectral type



Eruptive Variables with em spectral type



Eruptive Variables of type UV/UVN with em spectral type



Category: Eruptive

Type : UV

Eruptive variables of the UV Ceti type, these are K Ve-M Ve stars sometimes displaying flare activity with amplitudes from several tenths of a magnitude up to 6 mag. in V. The amplitude is considerably greater in the ultraviolet spectral region. Maximum light is attained in several seconds or dozens of seconds after the beginning of a flare; the star returns to its normal brightness in several minutes or dozens of minutes.

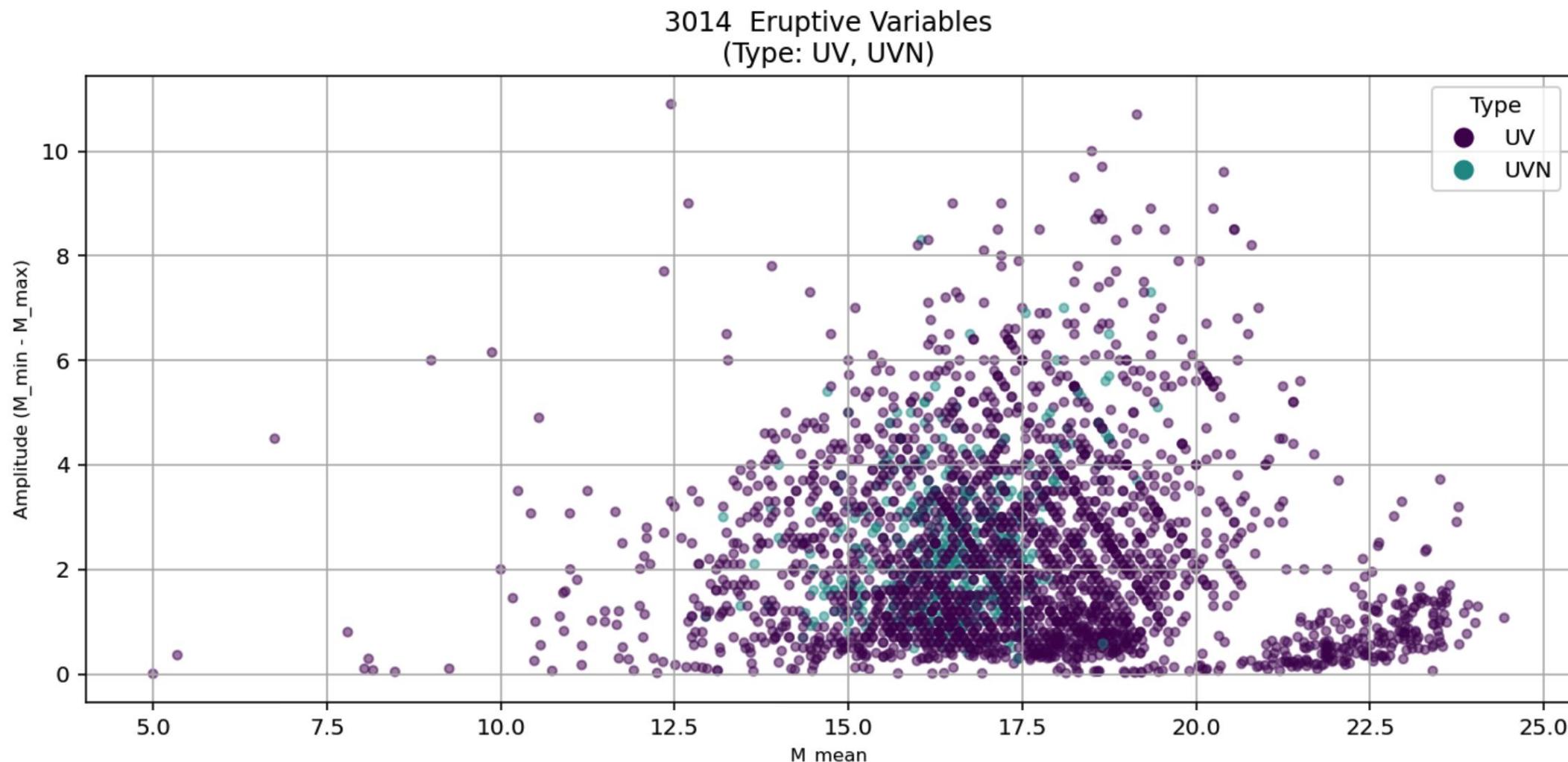
Category: Eruptive

Type : UVN

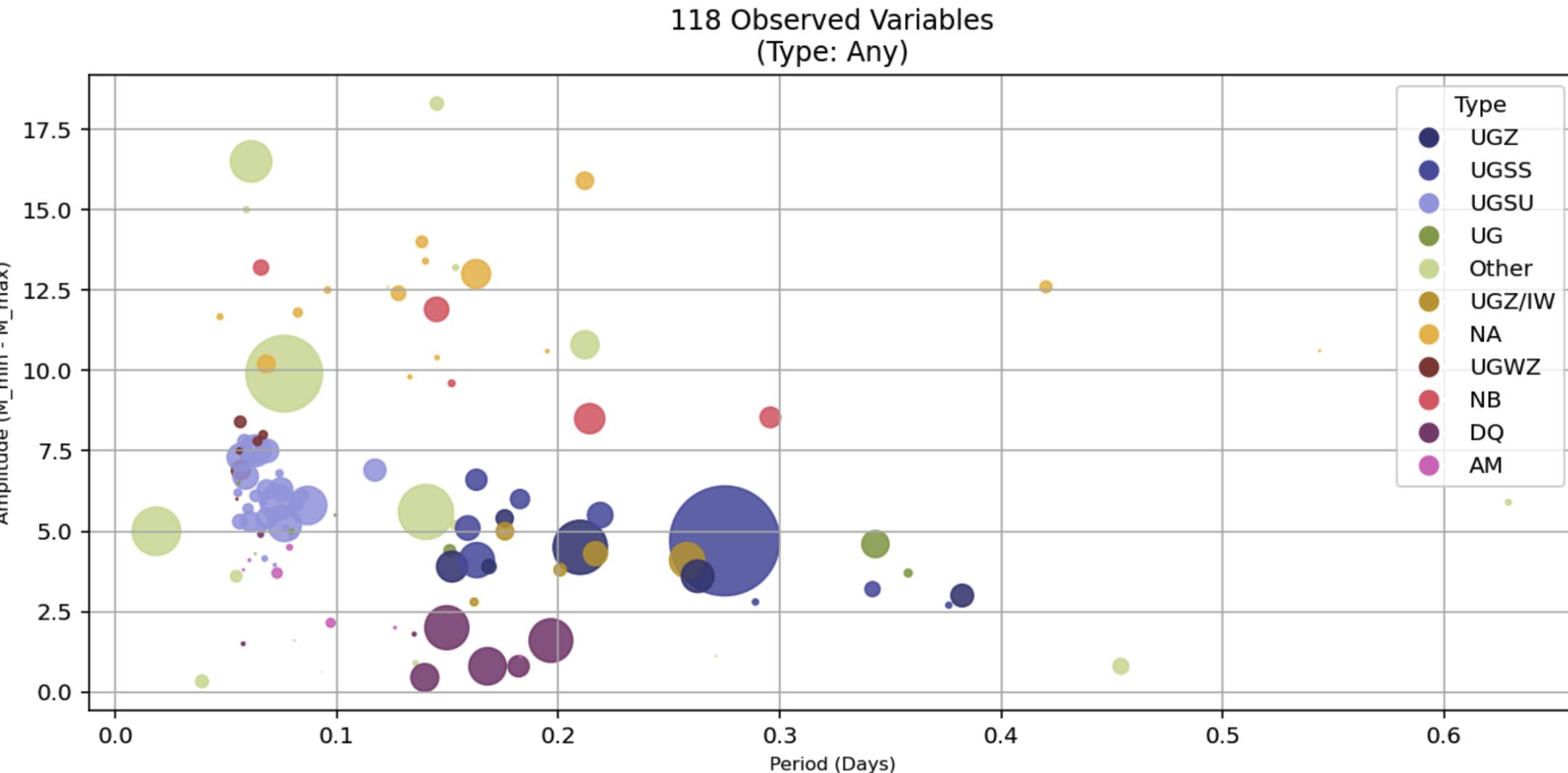
Flaring Orion variables of spectral types Ke-Me. These are phenomenologically almost identical to UV Ceti variables observed in the solar neighborhood. In addition to being related to nebulae, they are normally characterized by being of earlier spectral type and greater luminosity, with slower development of flares (Example: V389 Ori). They are possibly a specific subgroup of INB variables with irregular variations superimposed by flares.



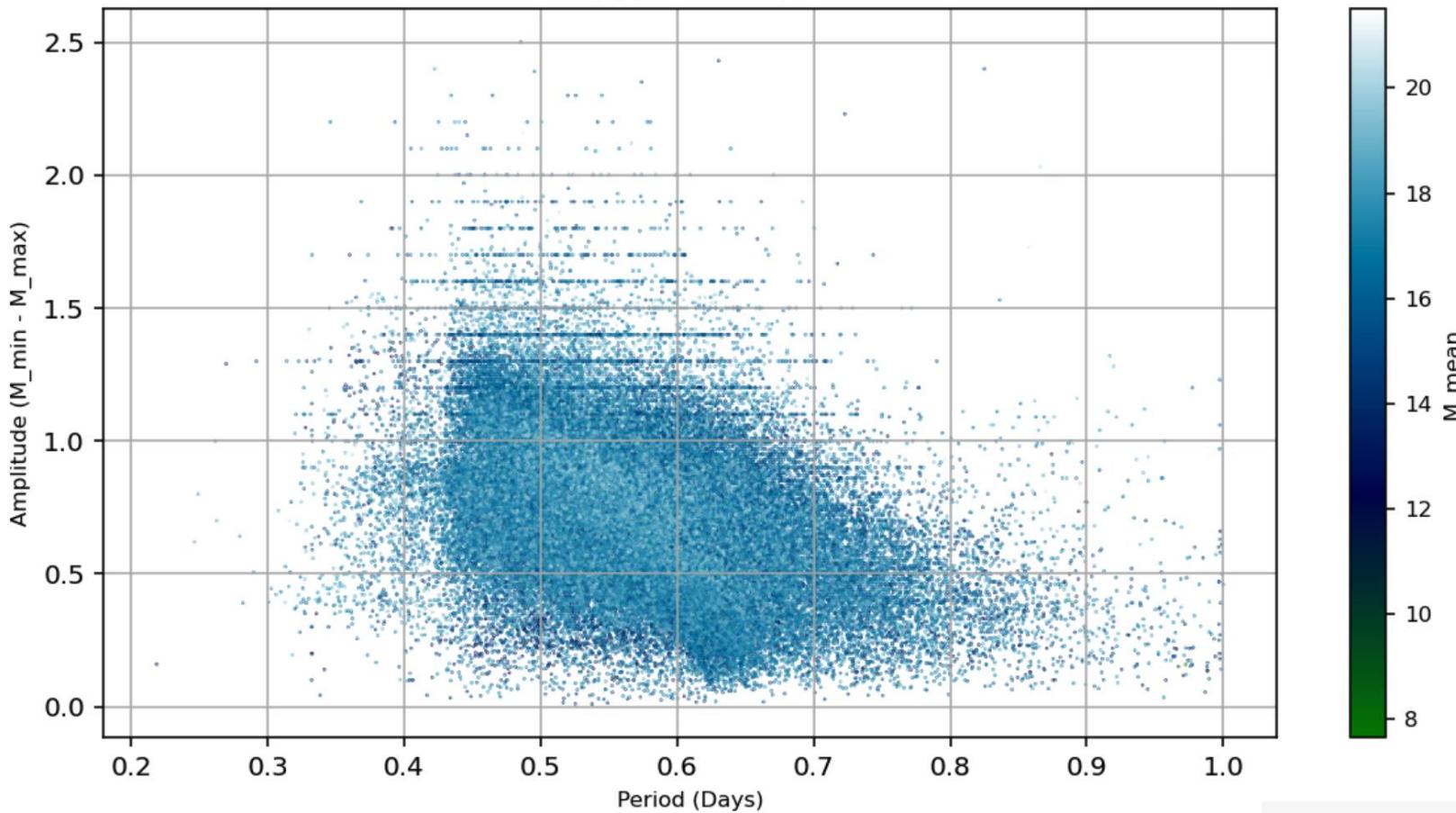
Eruptive Variables of type UV/UVN (All spectral types)



Stars with peculiar (pec) spectra



99846 Pulsating Variables (Type: RRAB)



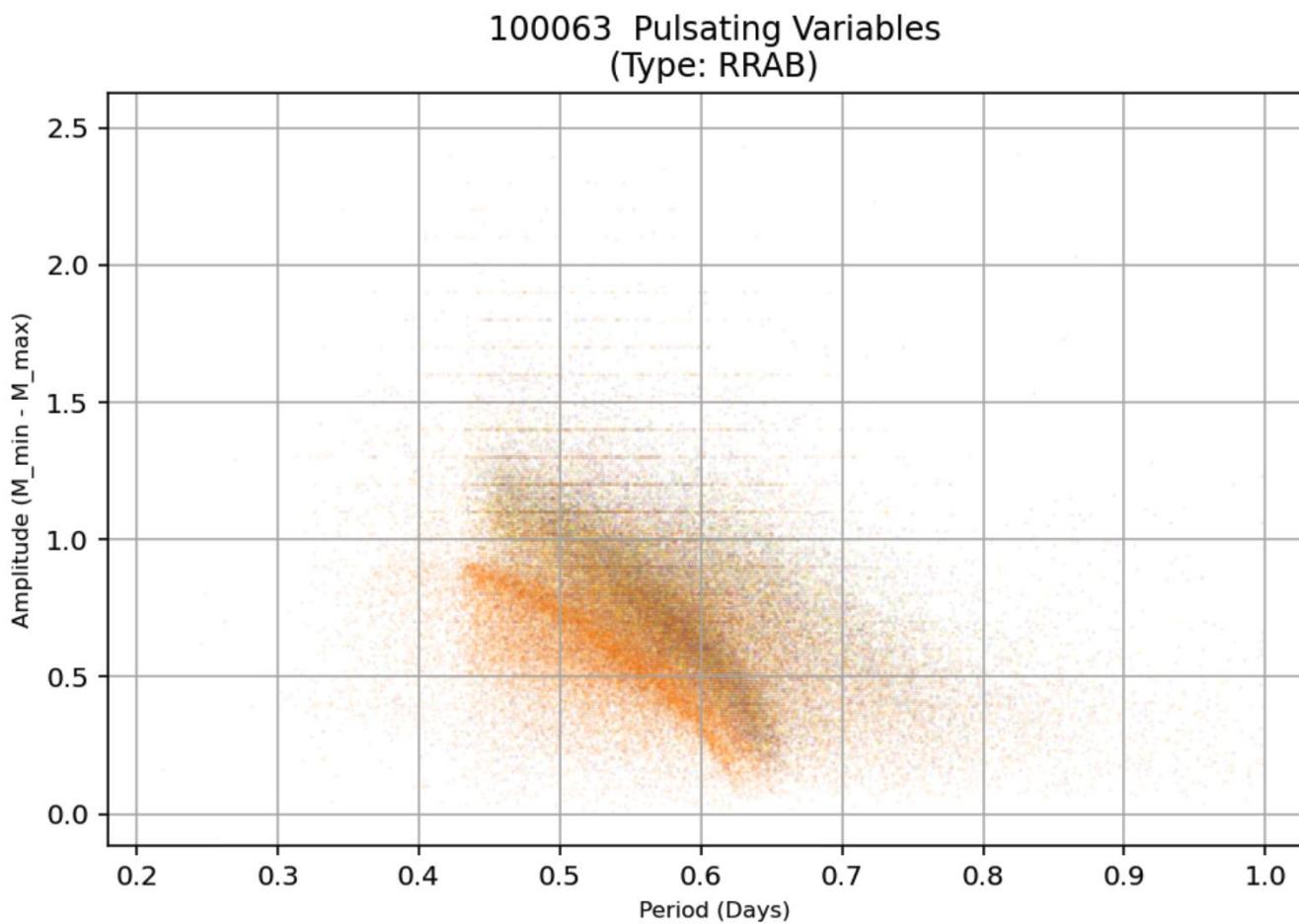
Category: Pulsating

Type : RRAB

RR Lyrae variables with asymmetric light curves (steep ascending branches), periods from 0.3 to 1.0 days, and amplitudes from 0.5 to 2 mag. in V. They are fundamental mode pulsators.



RRAB Stars: Disk vs. Halo



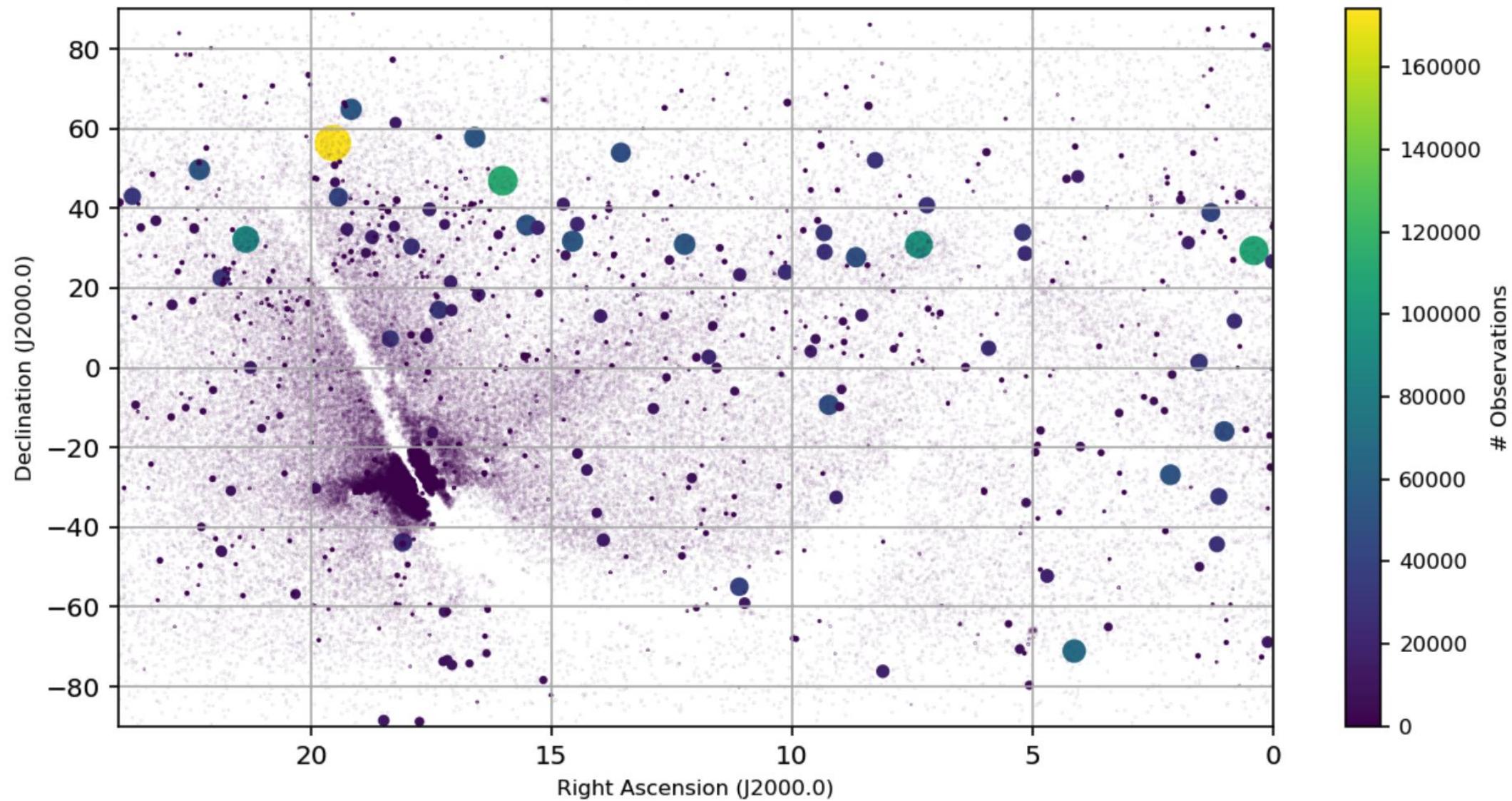
Disk RRAB Stars: The RR Lyrae stars in the Galactic disk are typically metal-rich and belong to the younger Population I stars. These stars generally have smaller amplitudes and longer periods.

Halo RRAB Stars: The RR Lyrae stars in the halo are typically metal-poor and belong to the older Population II stars. These stars generally have higher amplitudes and shorter periods.

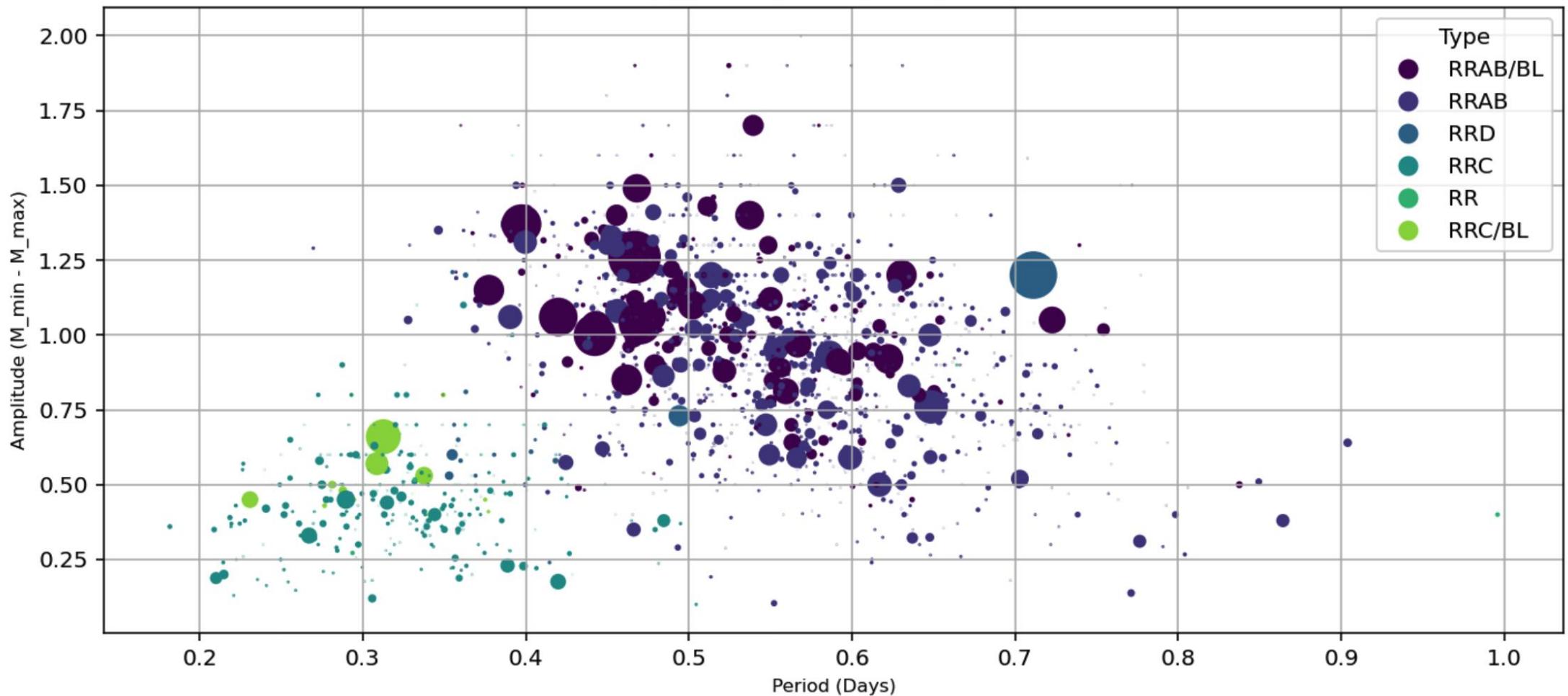
Source: ChatGPT-4o



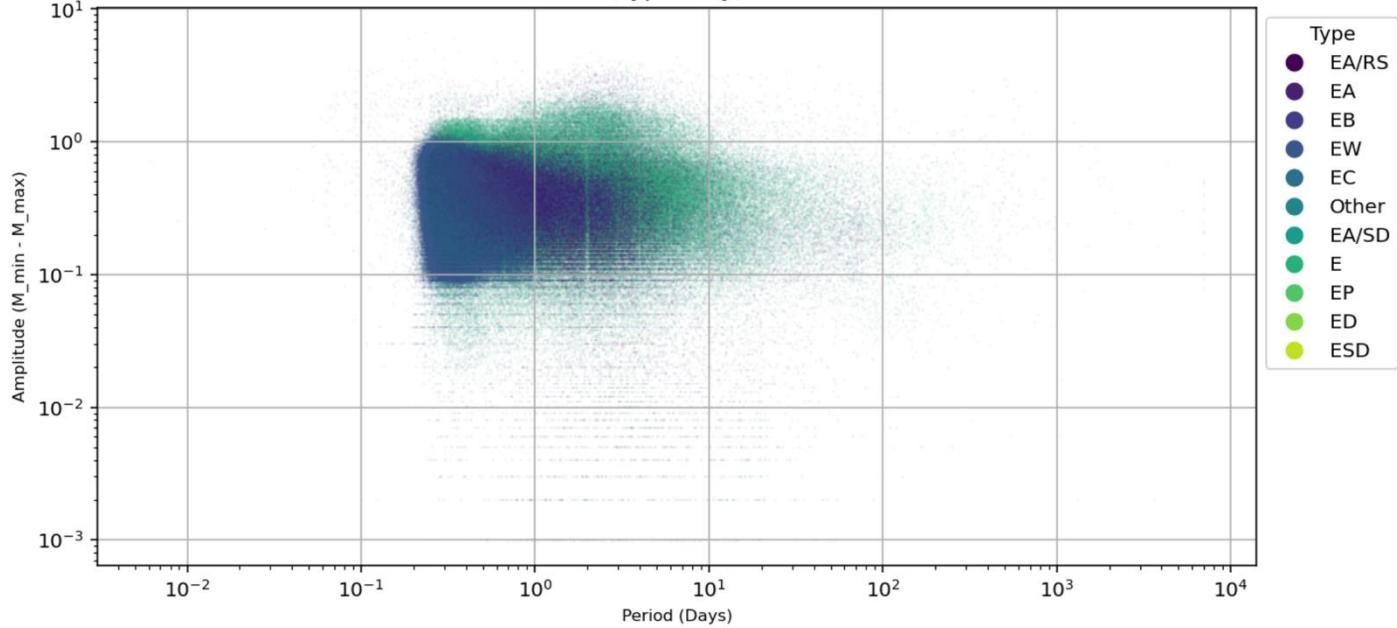
101121 Pulsating Variables (Type: RRAB)



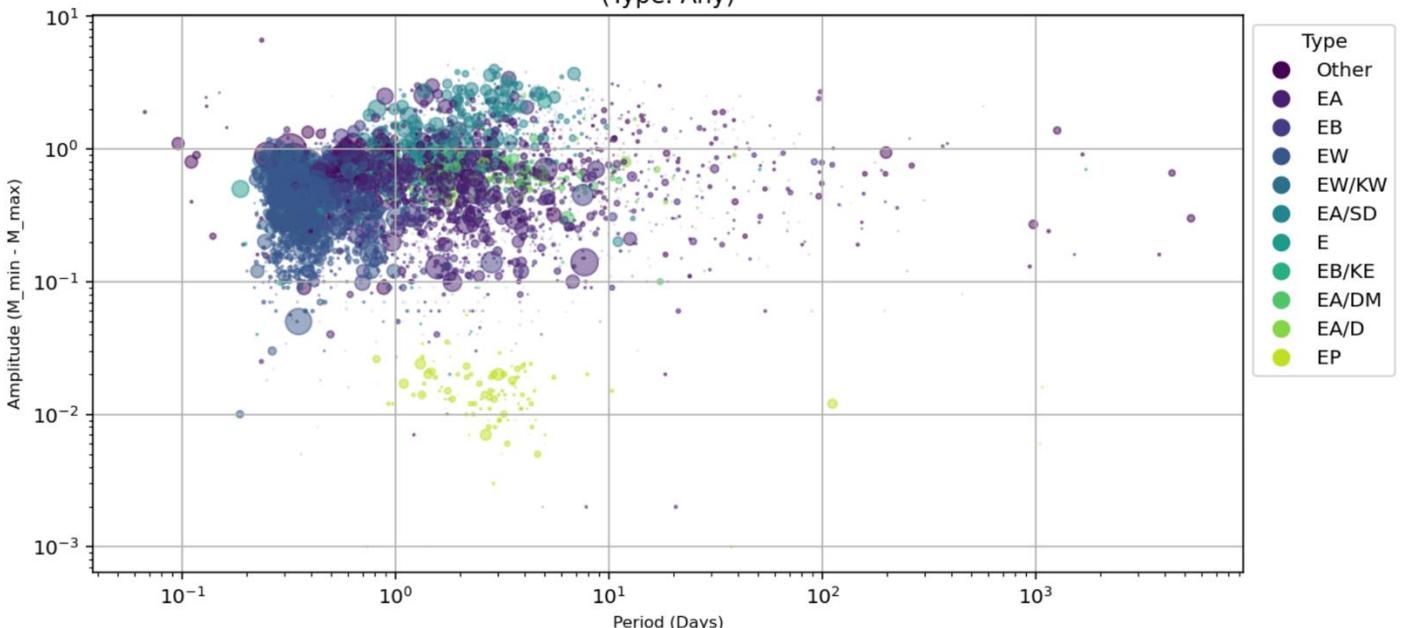
1667 Observed Pulsating Variables (Type: RR, RRAB, RRC, RRD)



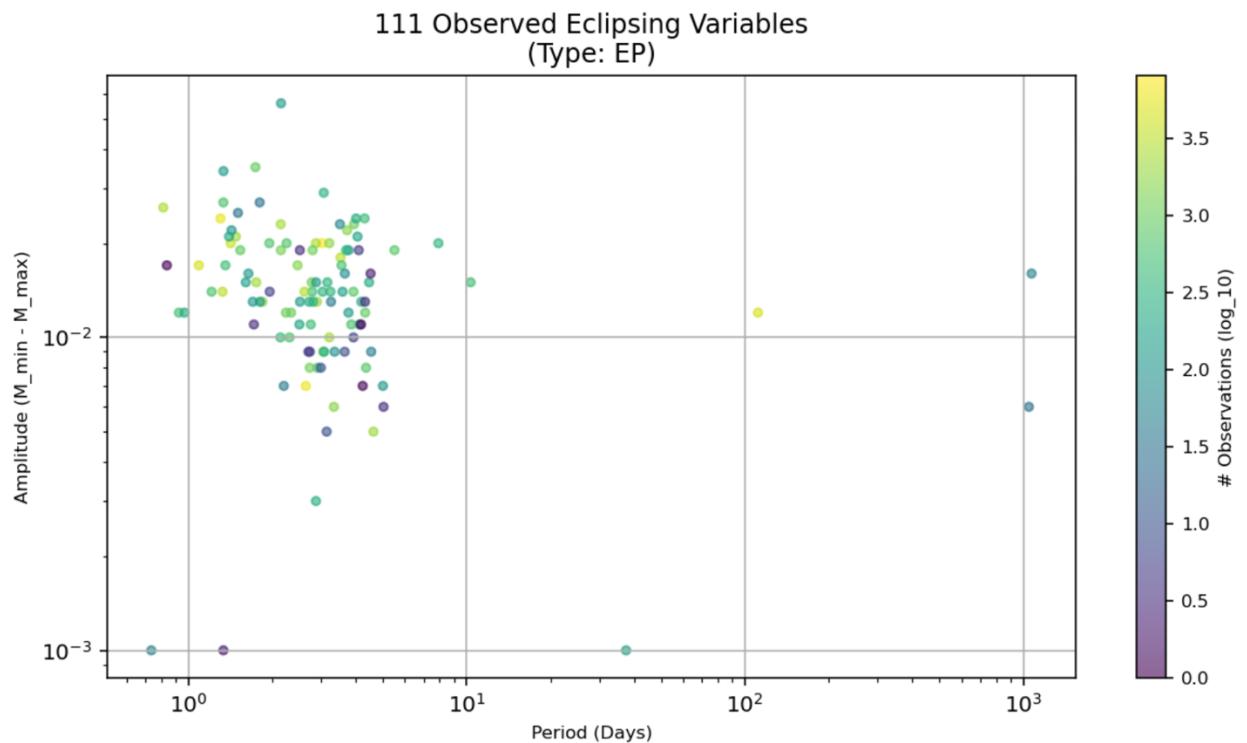
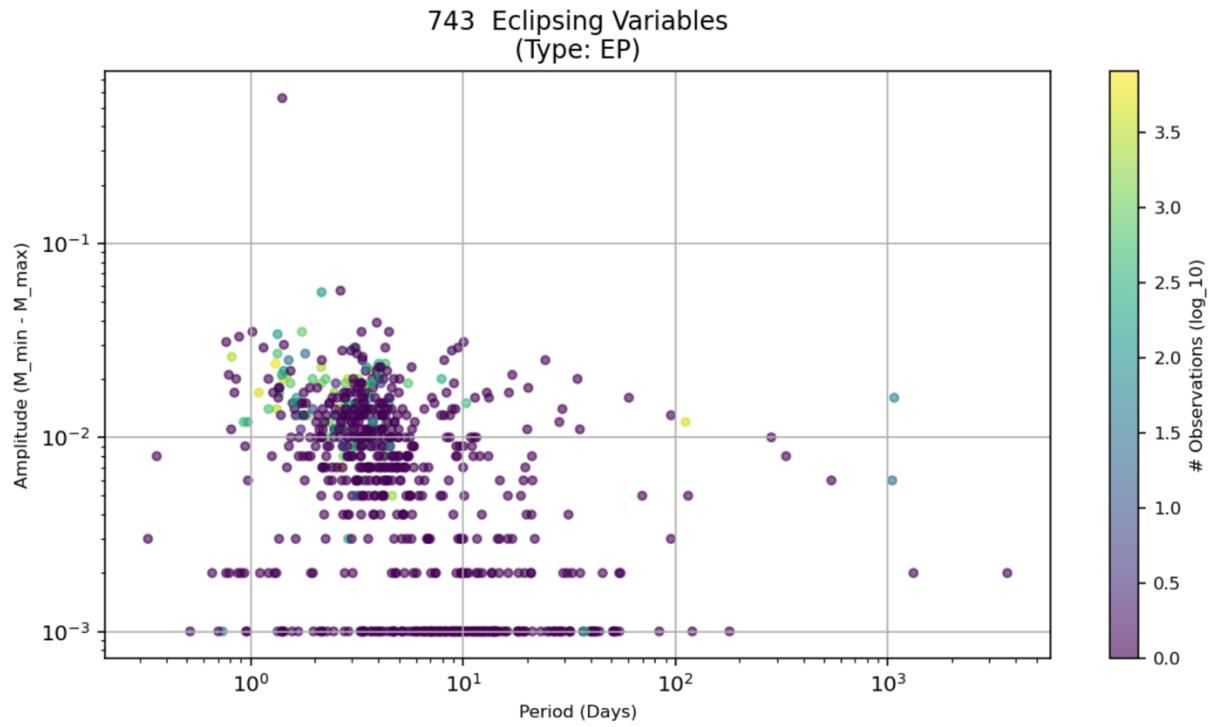
955303 Eclipsing Variables
(Type: Any)



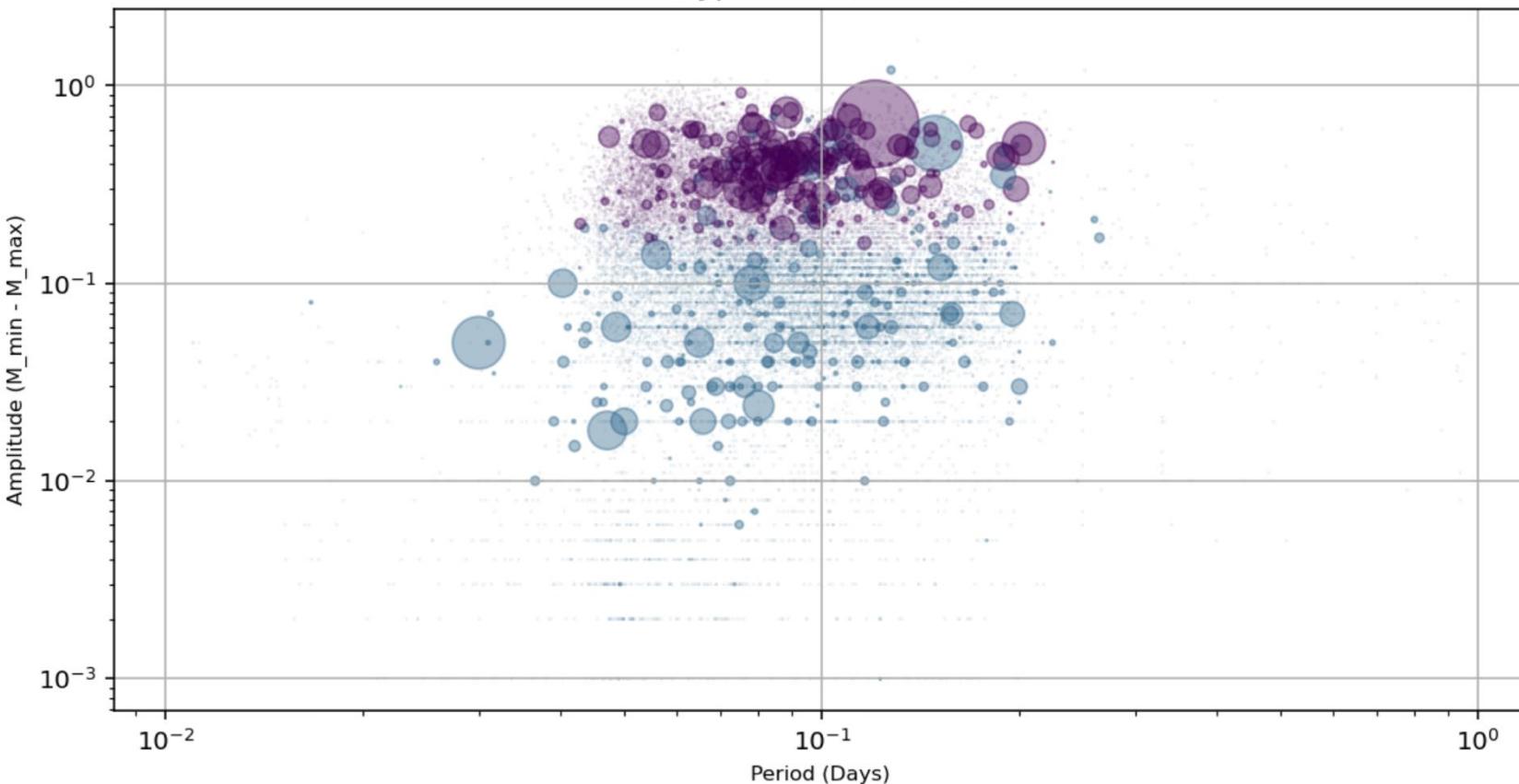
5993 Observed Eclipsing Variables
(Type: Any)



Exoplanets



26478 Pulsating Variables (Type: DSCT, HADS)



Category: Pulsating

Type : DSCT

Variables of the δ Scuti type. These are pulsating variables of spectral types A0-F5 III-V displaying light amplitudes from 0.003 to 0.9 mag. in V (those with amplitudes larger than 0.15 mag. and assymetric light curves are designated HADS) and periods from 0.01 to 0.2 days. The shapes of the light curves, periods, and amplitudes usually vary greatly. Radial as well as non-radial pulsations are observed. The variability of some members of this type appears sporadically and sometimes completely ceases, this being a consequence of strong amplitude modulation with the lower value of the amplitude not exceeding 0.001 mag. in some cases. The maximum of the surface layer expansion does not lag behind the maximum light for more than 0.1 periods. DSCT stars are representatives of the galactic disk (flat component), SXPHE stars are halo objects.

Category: Pulsating

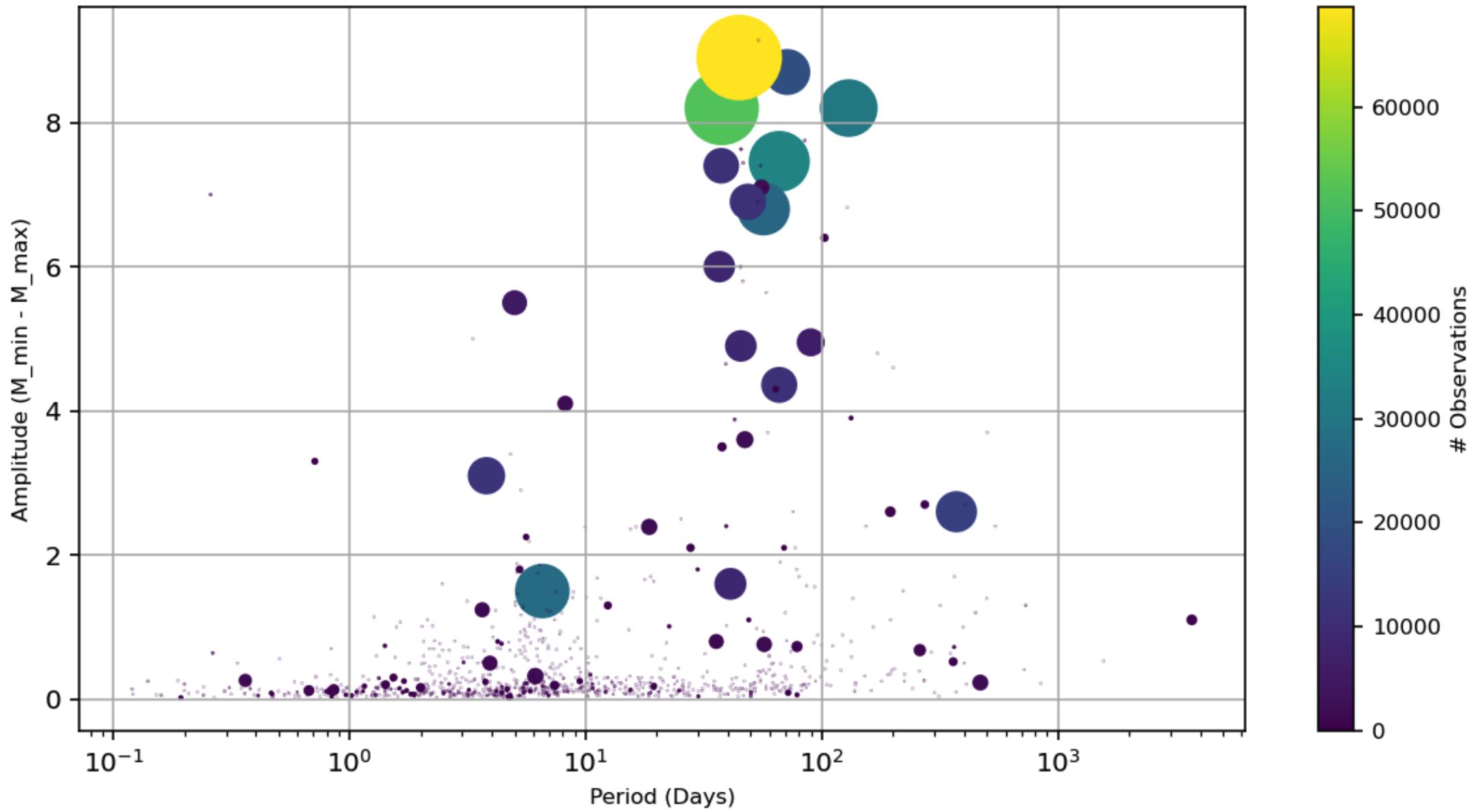
Type : HADS

High Amplitude δ Scuti stars. They are radial pulsators showing asymmetric light curves (steep ascending branches) and amplitudes >0.15 mag.

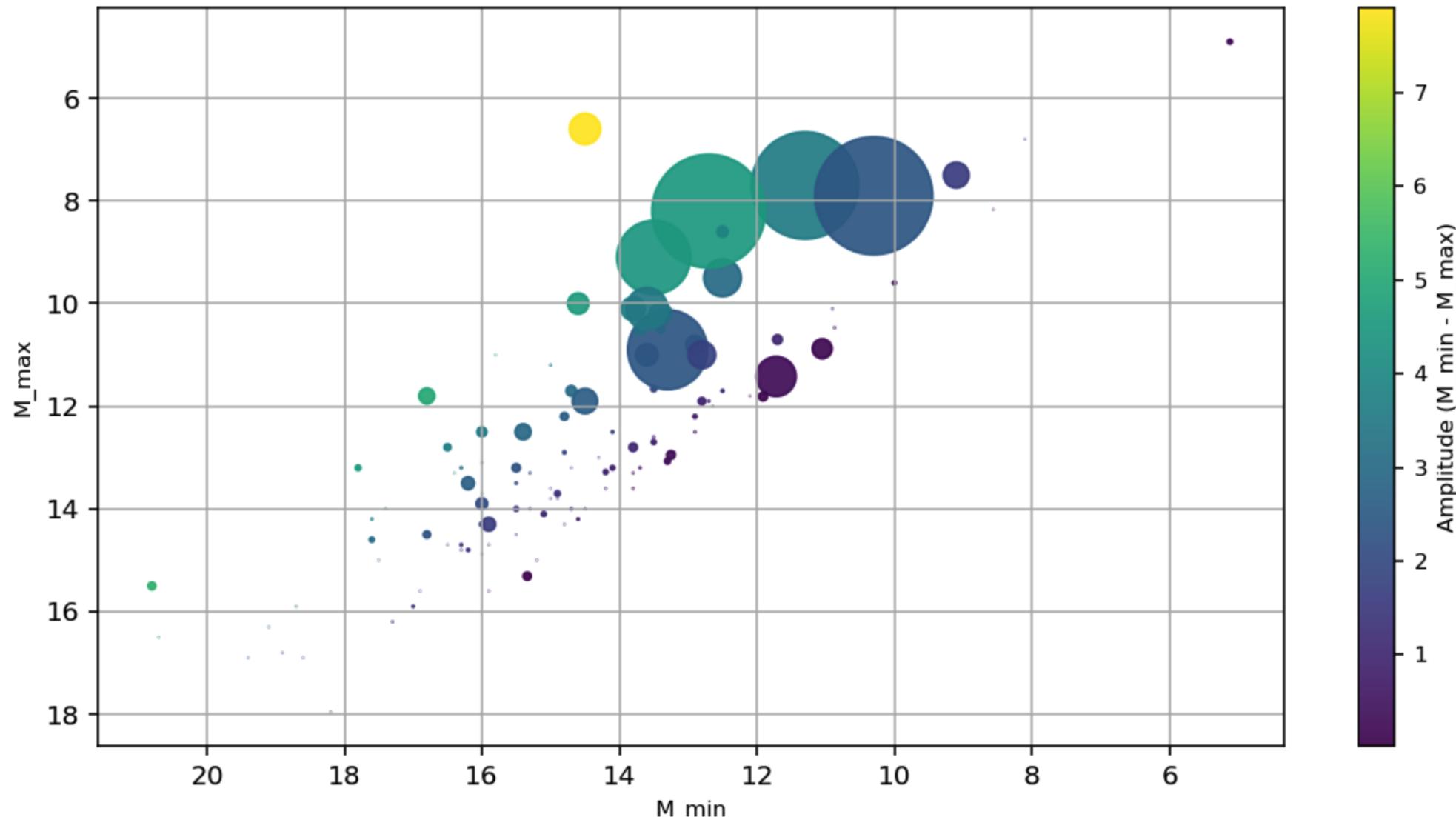
varcat	vtype	num	uncertain	nobs	nobs_max	period_min	period_avg	period_max	amplitude_min	amplitude_avg	amplitude_max
Pulsating	DSCT	15,495	0.015	589,213	55,649	0.010445	0.100965	0.95	-0.2	0.094177	1.69
Pulsating	HADS	10,982	0.007	1,001,801	136,073	0.030448	0.083736	0.620077	0.06	0.353581	1.19



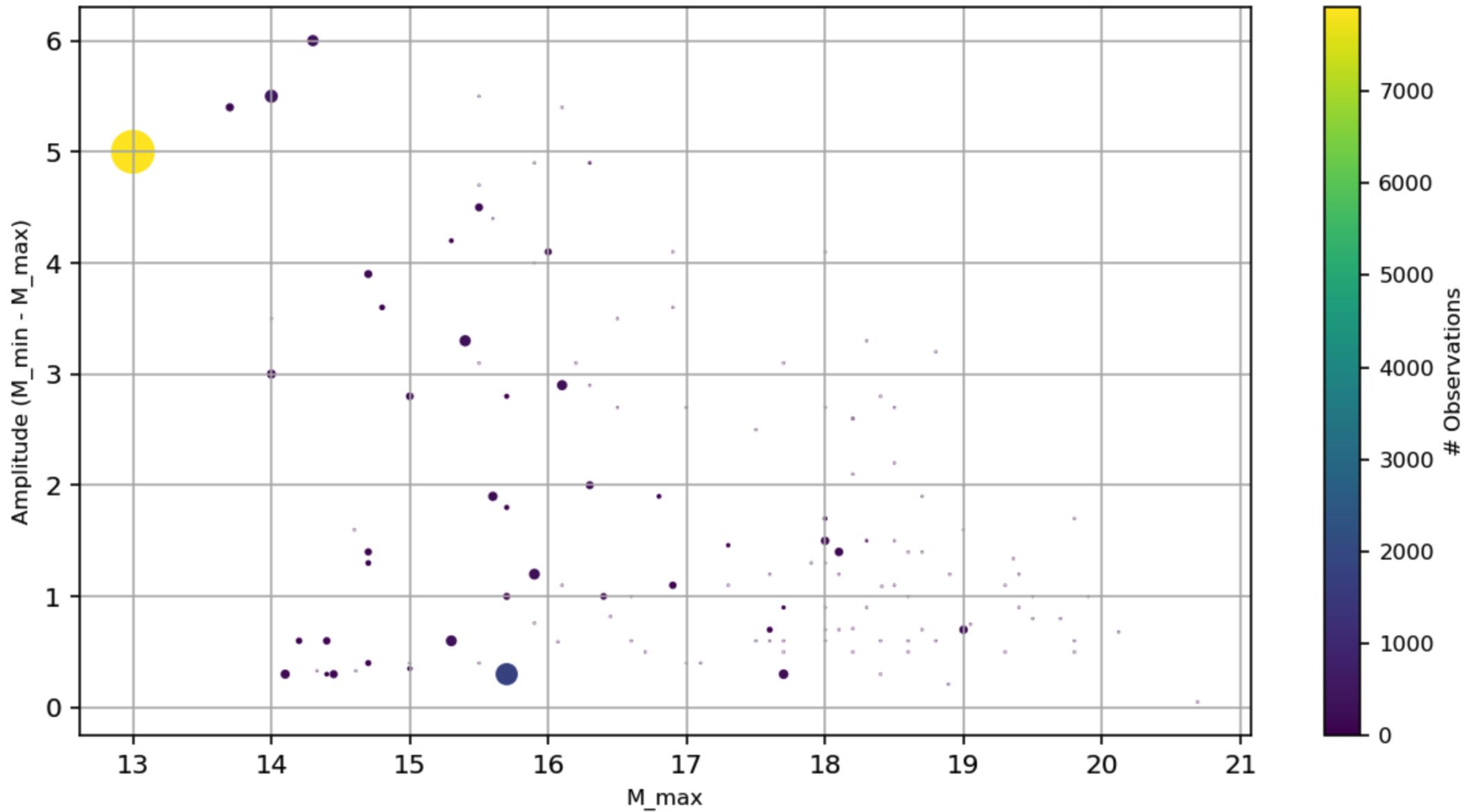
17004 Eruptive variables (all types)



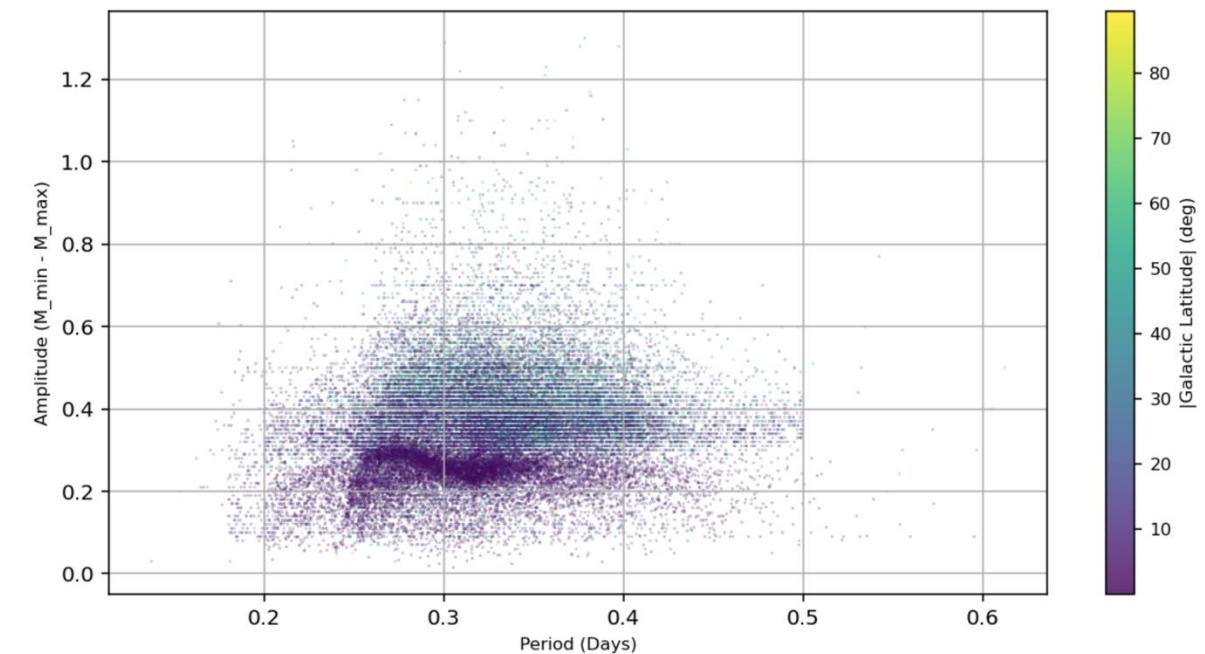
200 Cataclysmic Variables (Type: ZAND)



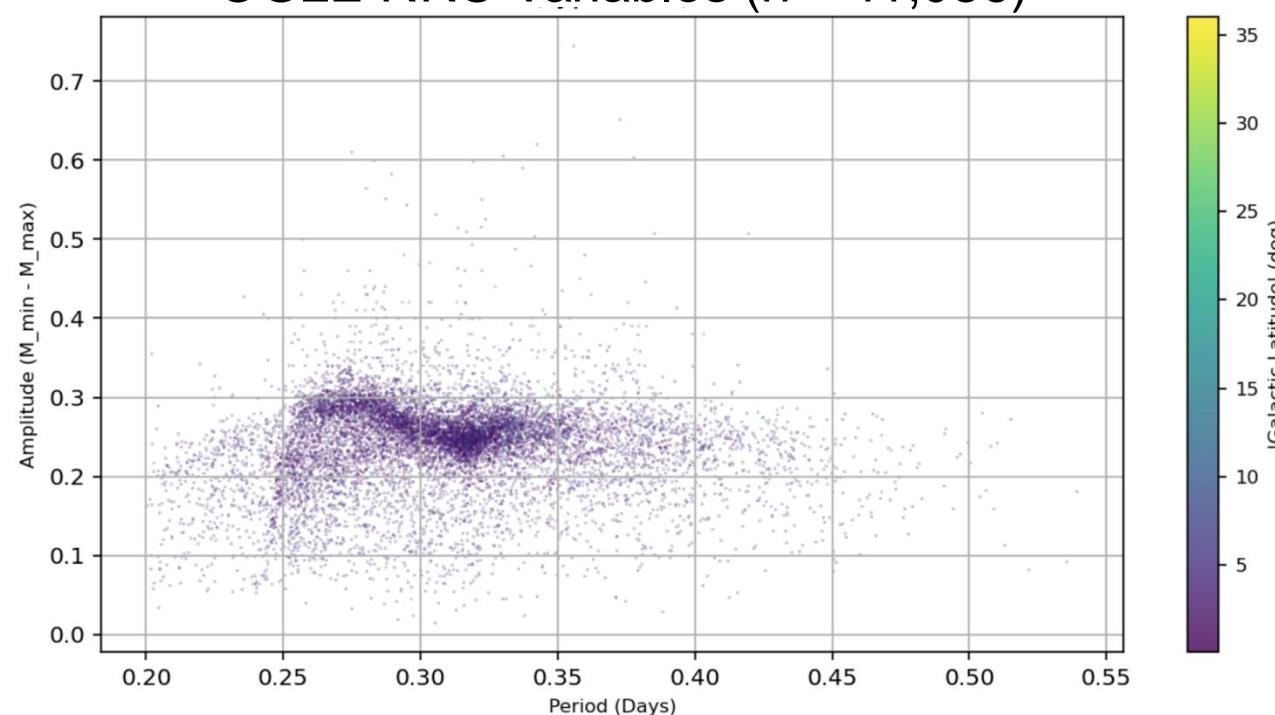
208 Other variables: (type: QSO)



All RRC Variables (n = 39,852)



OGLE RRC Variables (n = 11,086)



DCEP Target Selection

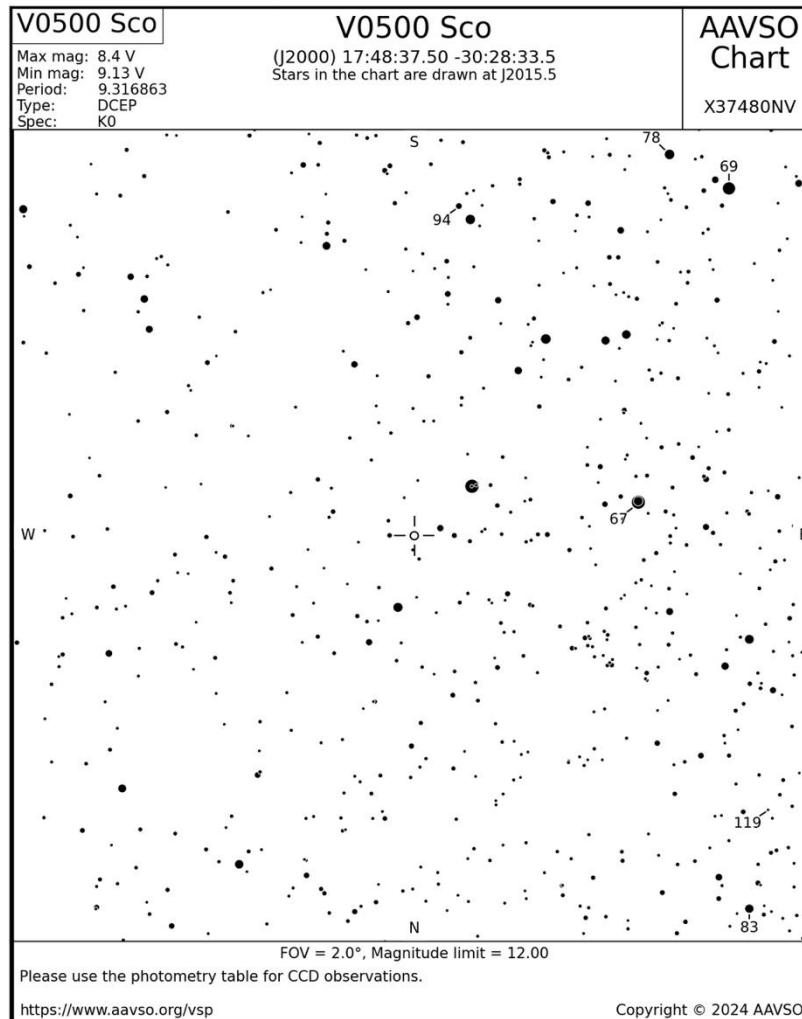
Catalog	Plot															
oid	con	name	varcat	vartype	nobs	magmax	magmin	magmean	amplitude	period	spectype	ra2000	dec2000			
32,833	Sco	RY Sco	Pulsating	DCEP	2,724	7.51	8.36		0.85	20.323	F6-G2	17h50m52s	-33°42'20"			
32,830	Sco	RV Sco	Pulsating	DCEP	2,504	6.61	7.49		0.88	6.06147	F5-G1	16h58m20s	-33°36'33"			
33,452	Sco	V0636 Sco	Pulsating	DCEP	480	6.37	6.91		0.54	6.796992	F7/8Ib/II-G5	17h22m46s	-45°36'51"			
33,298	Sco	V0482 Sco	Pulsating	DCEP	308	7.63	8.3		0.67	4.527807	F5	17h30m48s	-33°36'36"			
33,066	Sco	KQ Sco	Pulsating	DCEP	278	9.33	10.26		0.93	28.705	F5-K7Ia	16h51m39s	-45°25'36"			
33,316	Sco	V0500 Sco	Pulsating	DCEP	134	8.4	9.13		0.73	9.316863	K0	17h48m37s	-30°28'33"			

- DCEP stars in the constellation Scorpio with an amplitude > 0.50 and a max magnitude < 10.0
- These stars should be accessible to my equipment and experience level.
- I notice that **V0500 Sco** is somewhat under-observed (probably due to a less complete sequence.)



Variable Star Plotter (VSP)

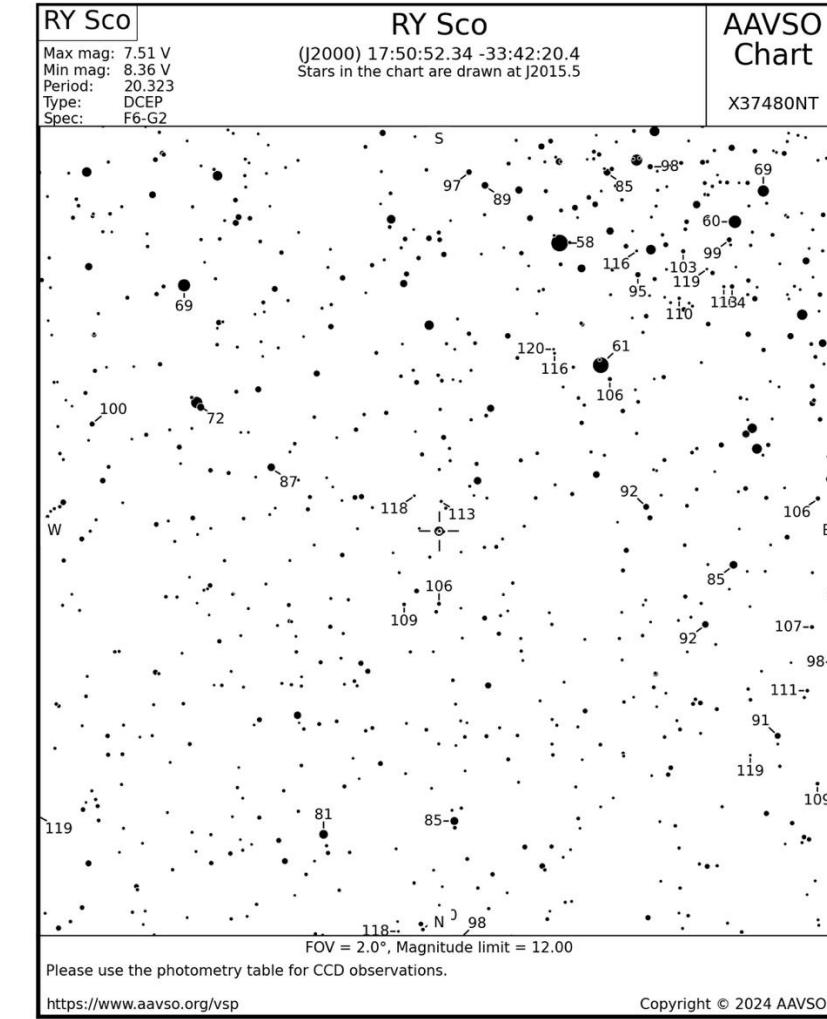
Source: AAVSO



134 Observations



Northeastern University



2724 Observations

Future Directions

- Open-source access to all code
- Automated pipeline for data updates
- Database migration to MySQL
- Integration with AAVSO observing campaigns and alerts
- Enhanced API for passband filtering, magnitude limits, variability subtypes
- Enhanced visualization and plotting options: Map projections, histograms, regression analysis, Kernel Density Estimate (KDE) plots, marker size legend, marker shape options.
- Hosted for public access



The VSXplore Team



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Dr. John Rachlin
Associate Teaching Professor
Northeastern University
Observer code: RJOJ



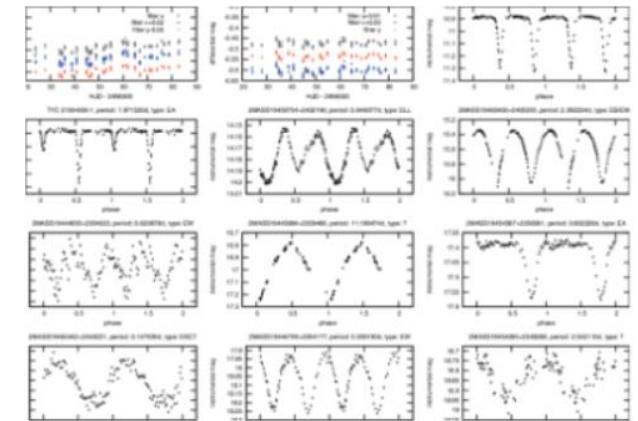
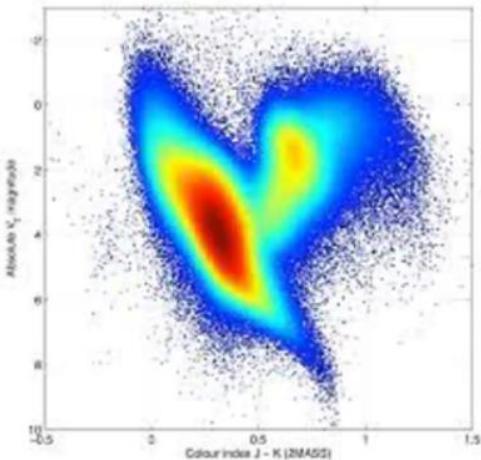
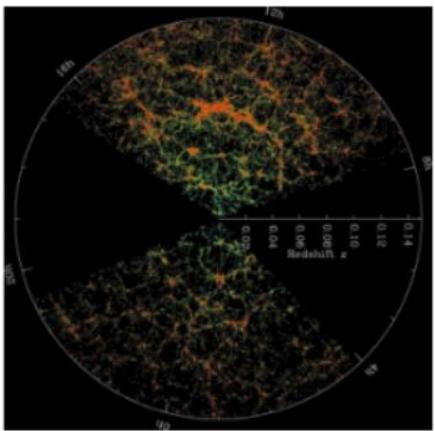
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RISE The RISE logo consists of the word "RISE" in a bold, red, sans-serif font next to a white silhouette of a human head profile facing right.

N Northeastern University
Khoury College
of Computer
Sciences

DS 4973: Astronomical Data Mining

Fall 2024: Tue and Fri (3:25 – 5:05) with Dr. John Rachlin



Astronomical surveys including the Sloan Digital Sky Survey, Pan-STARRS, Gaia, and the Transiting Exoplanet Survey Satellite (TESS) have produced vast quantities of data in the form of images and object catalogs. In the past decade, Astronomical Data Mining (or Astroinformatics) has become an important interdisciplinary field of research. This course is designed to introduce students to the principles and practices of this emerging topic, equipping them with the data science skills necessary to analyze, interpret, visualize, and make discoveries with astronomical datasets. Through weekly research paper reviews and programming assignments, students will learn the fundamentals of astronomical data mining, gain hands-on experience with current astronomical catalogs, and review case studies of major discoveries made through data-intensive astronomical research.





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