

Variable Stars

An iPhone Database Project



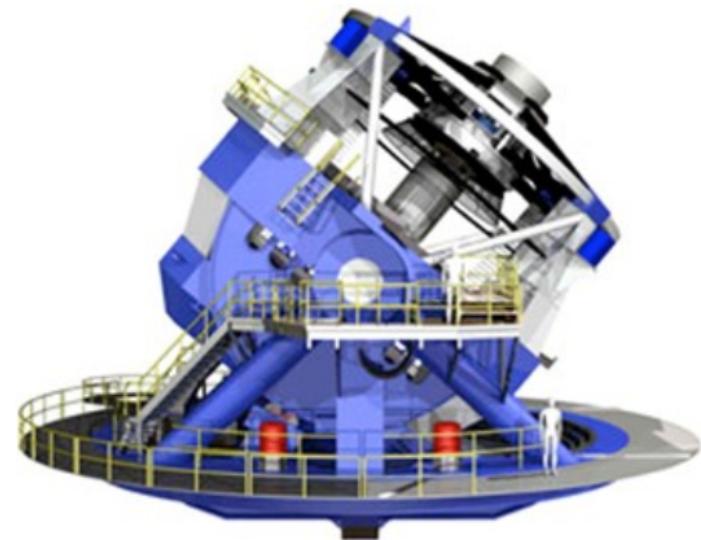
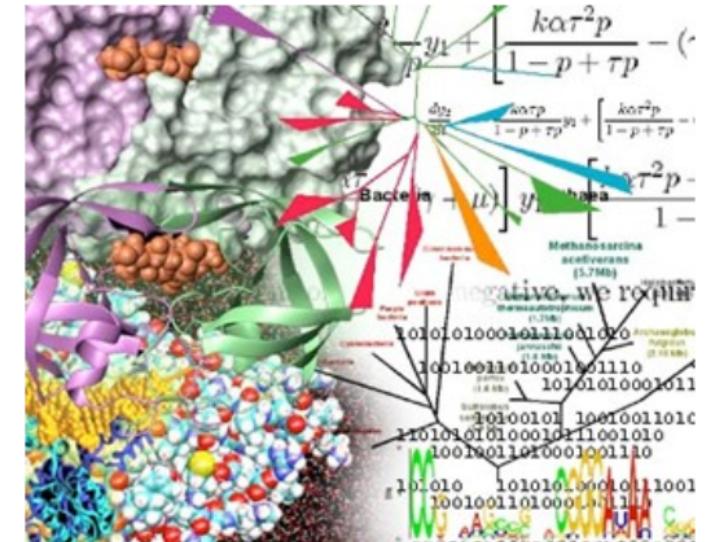
Northeastern University

Motivation

The Post-Genomic Era: Bioinformatics is a major scientific endeavor driving research in biomedical science and drug discovery.

The rise of survey astronomy: current and future wide-field surveys across the spectrum creating massive astronomical catalogues (and exciting opportunities for *in silico* discovery through data-mining).

GOAL: Create a generic framework for converting modest data sets (< 1 million records) into an app for the iOS platform (iPhone, iPod Touch, and iPad) that would enable searching, sorting, and viewing of data (with data analysis capability to follow).



What are variable stars?

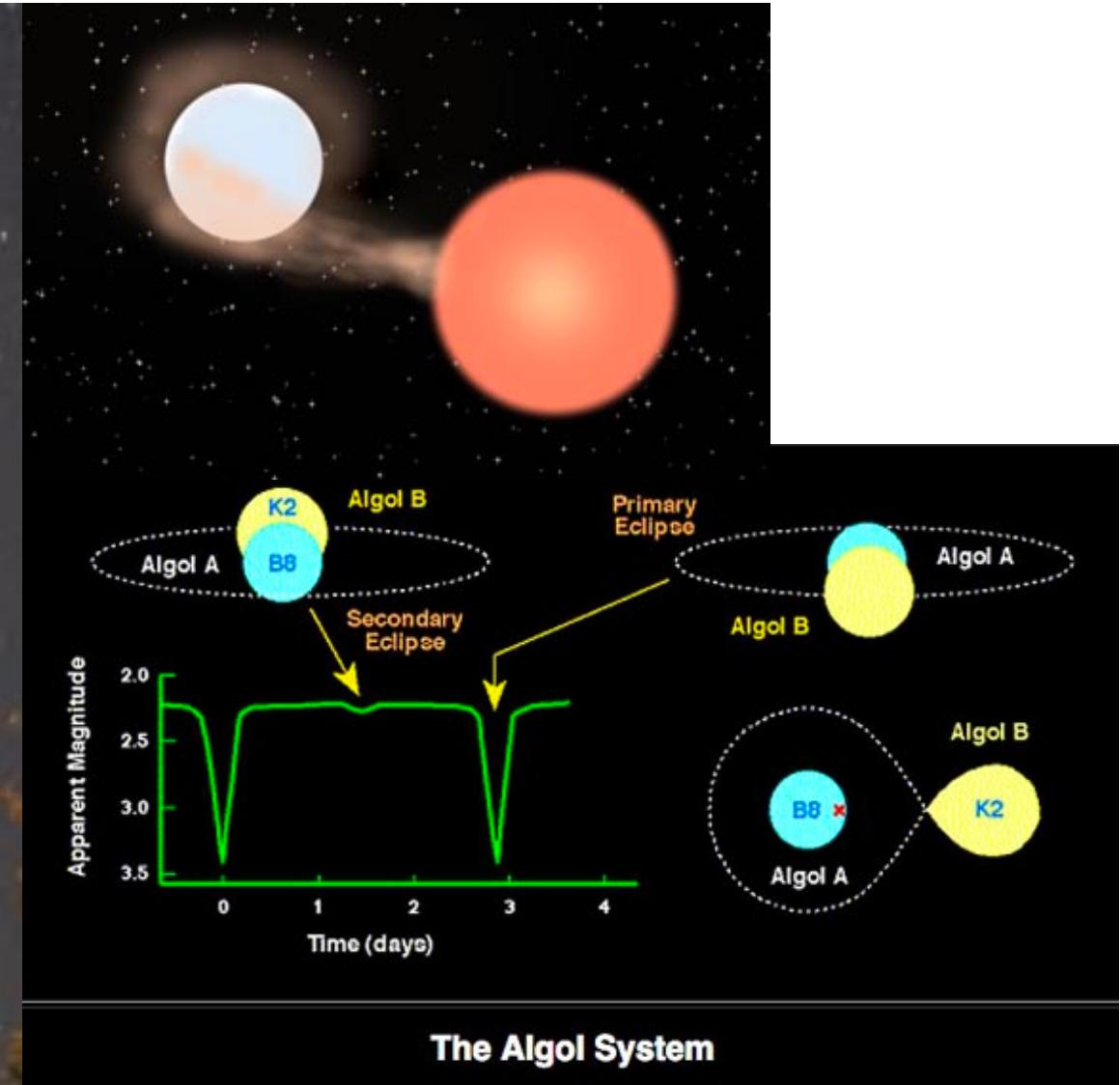
Variable stars are stars that vary in brightness.

There are many different kinds of variable stars.

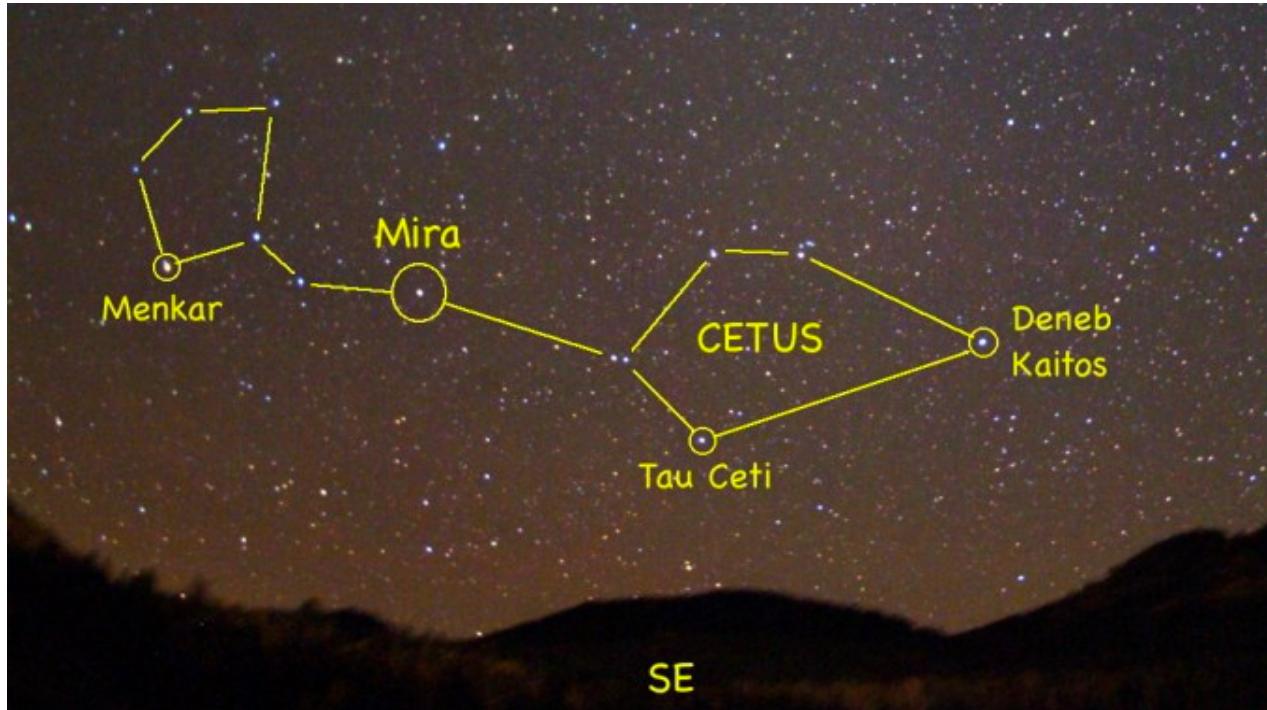
Over 450,000 variable stars have been catalogued, most of them within the last 10 years.



Algol – an eclipsing binary



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



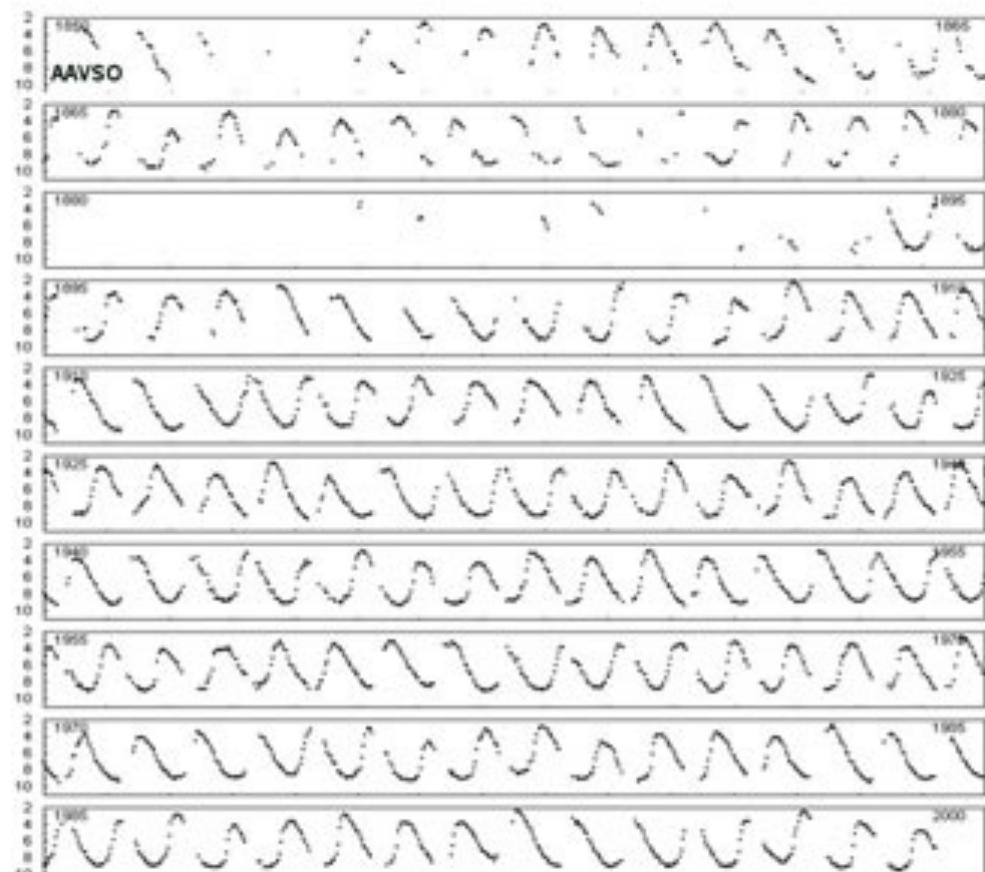
Range: 2.0 – 10.1
Period: 332 days



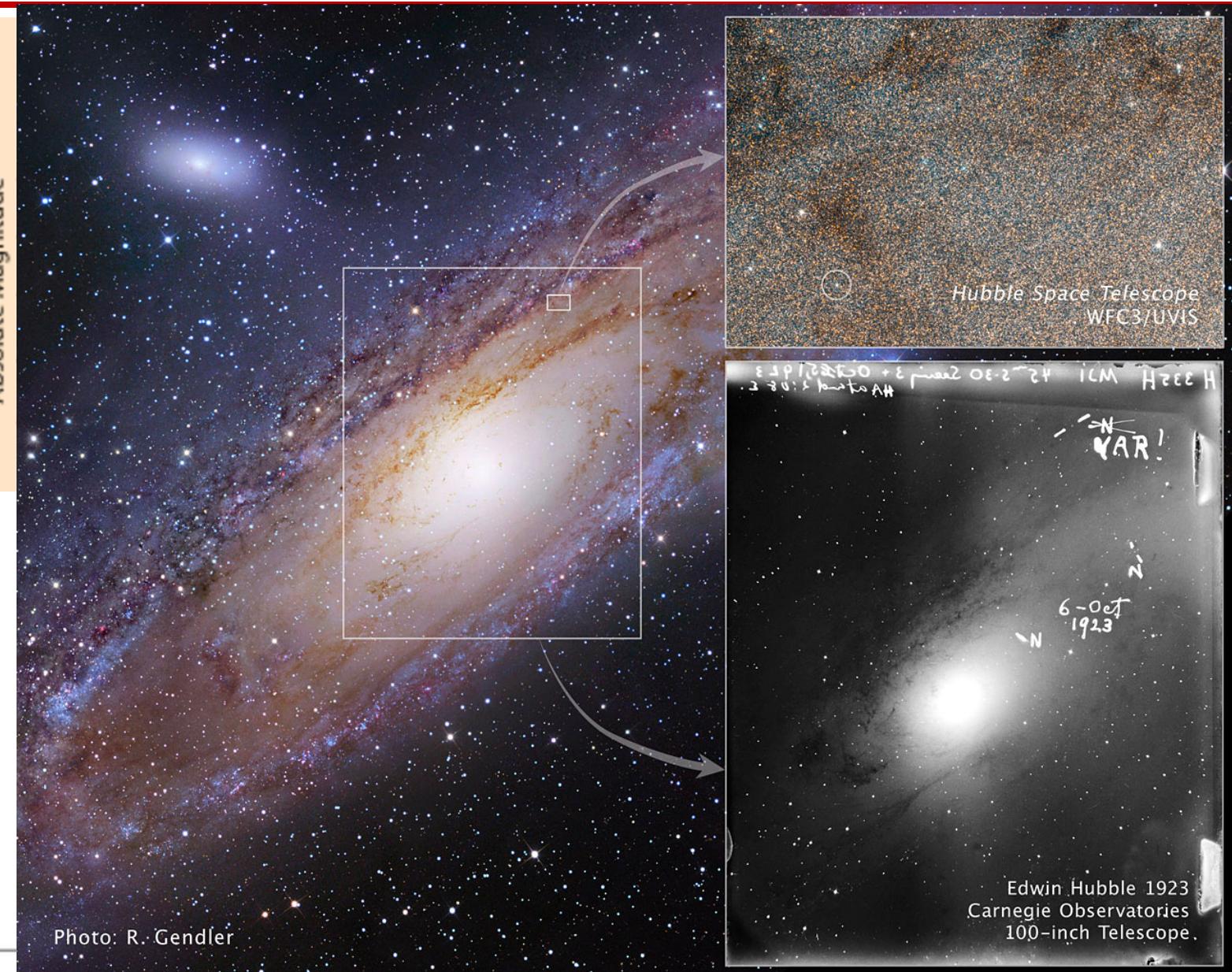
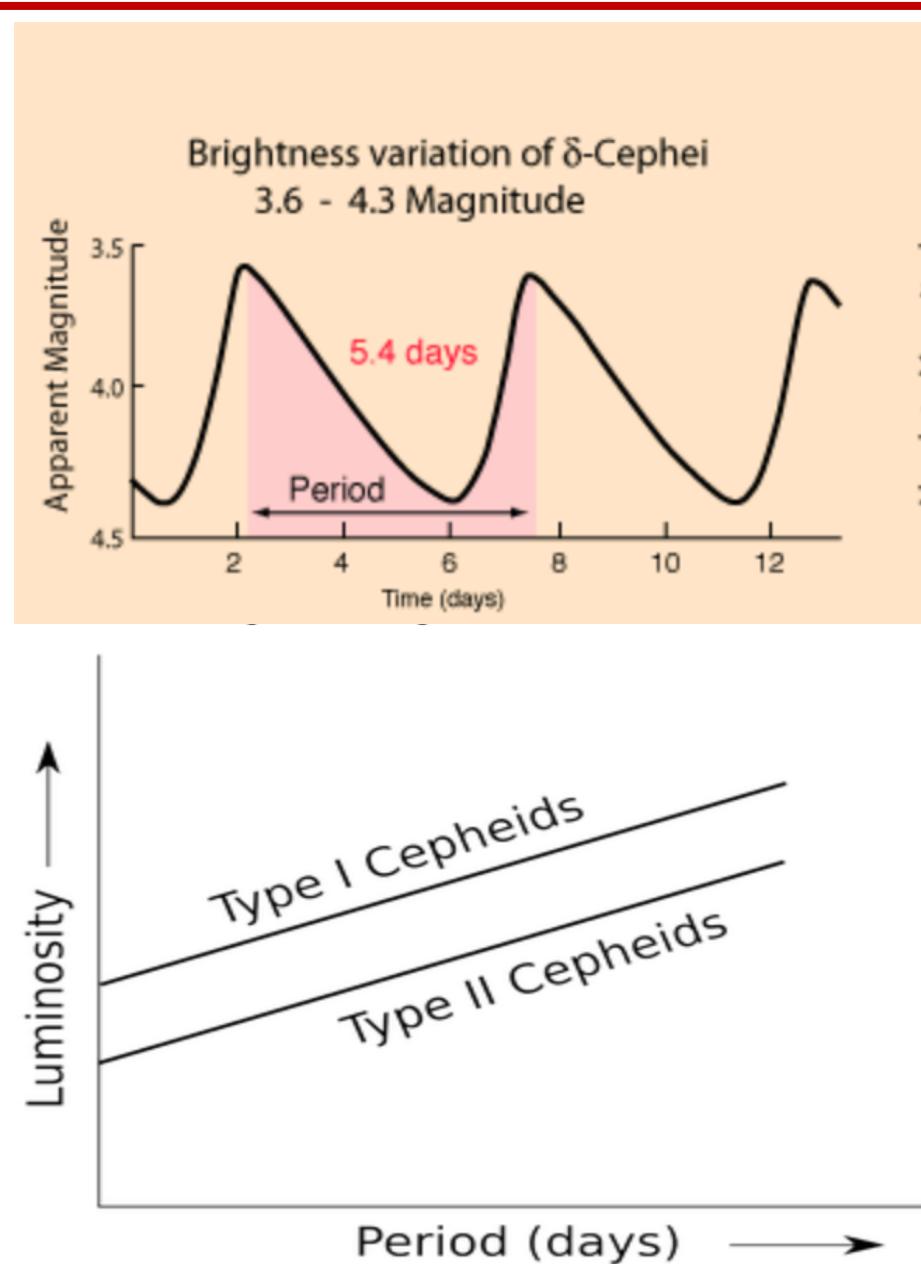
Mira (LPV) 1850-2000 (10-day means)

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 GW170817), and JAAVSO (Journal of the American Association of Variable Star Observers). A large orange banner at the bottom right displays "Variable Star Observations in Database: 3 4, 2 1 1, 9 6 3 and Counting ...".



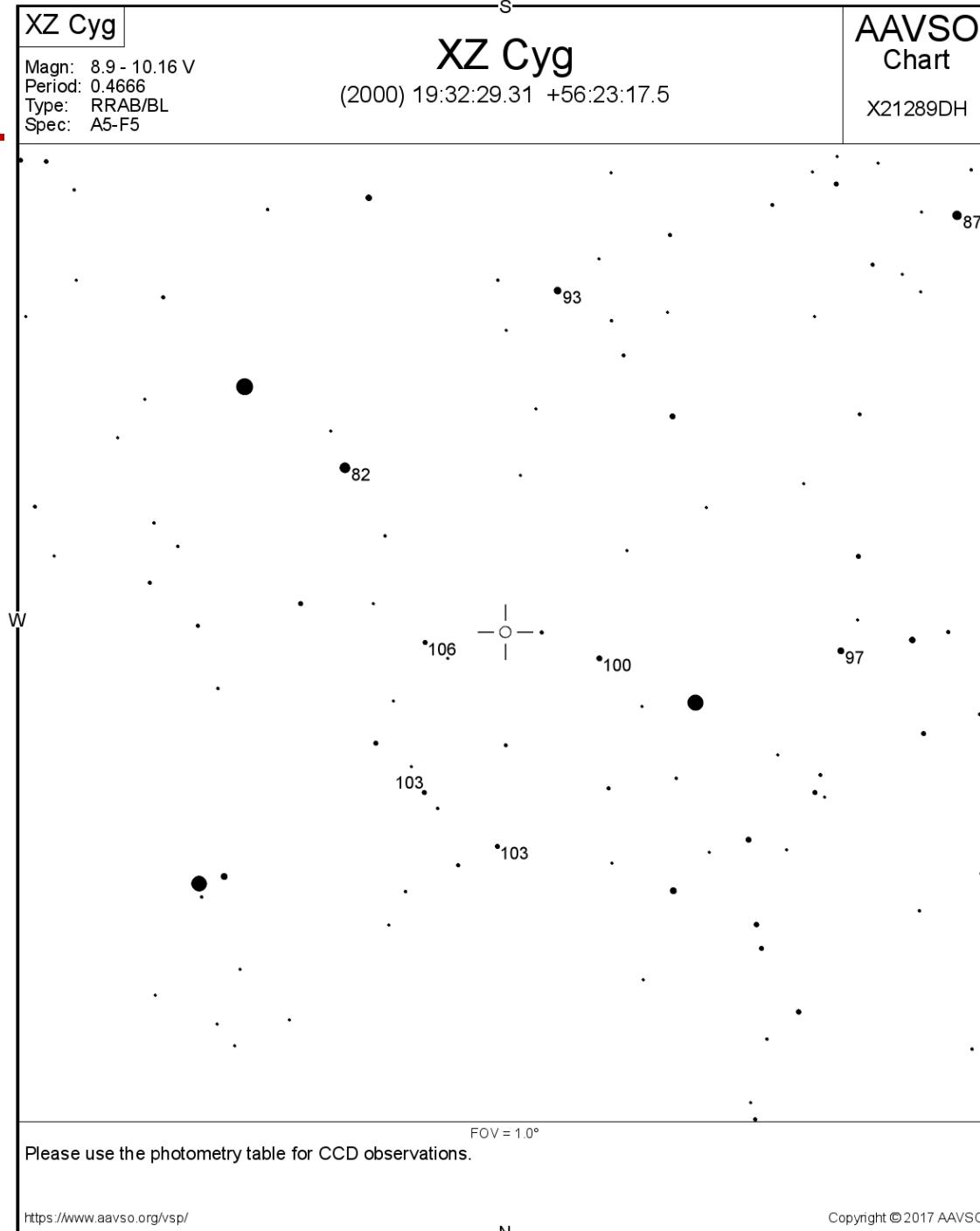
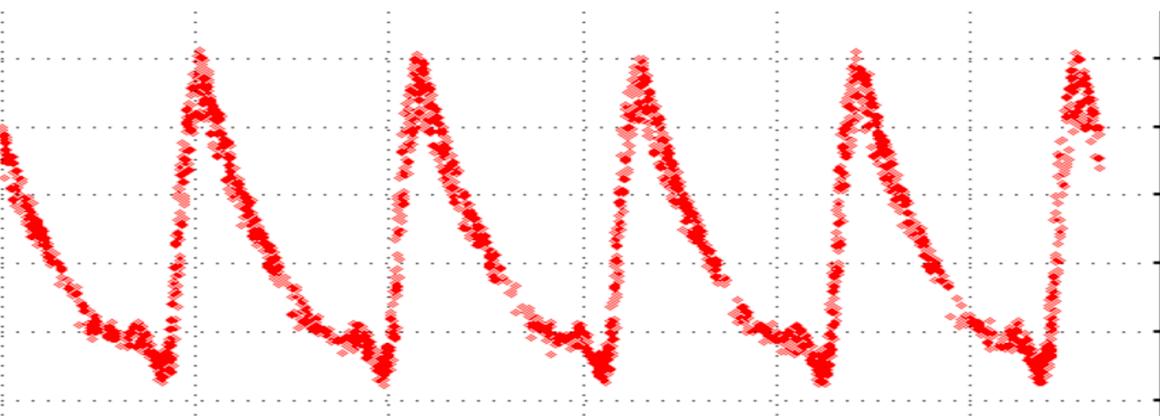
Northeastern University

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.





Centre de Données astronomiques de Strasbourg

Strasbourg astronomical Data Center

Search Criteria

Save in CDSportal

Keywords

- B/vsx/vsx

Tables

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

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

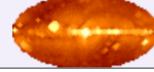
Position in:

- Sexagesimal
- Decimal °

Simple Target List Of Targets

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

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

B/vsx AAVSO International Variable Star Index VSX (Watson+, 2006-2014) [Similar Catalogs](#) [2006SASS...25..47W](#) [ReadMe+ftp](#) 

[Post annotation](#)

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

Simple Constraint List Of Constraints

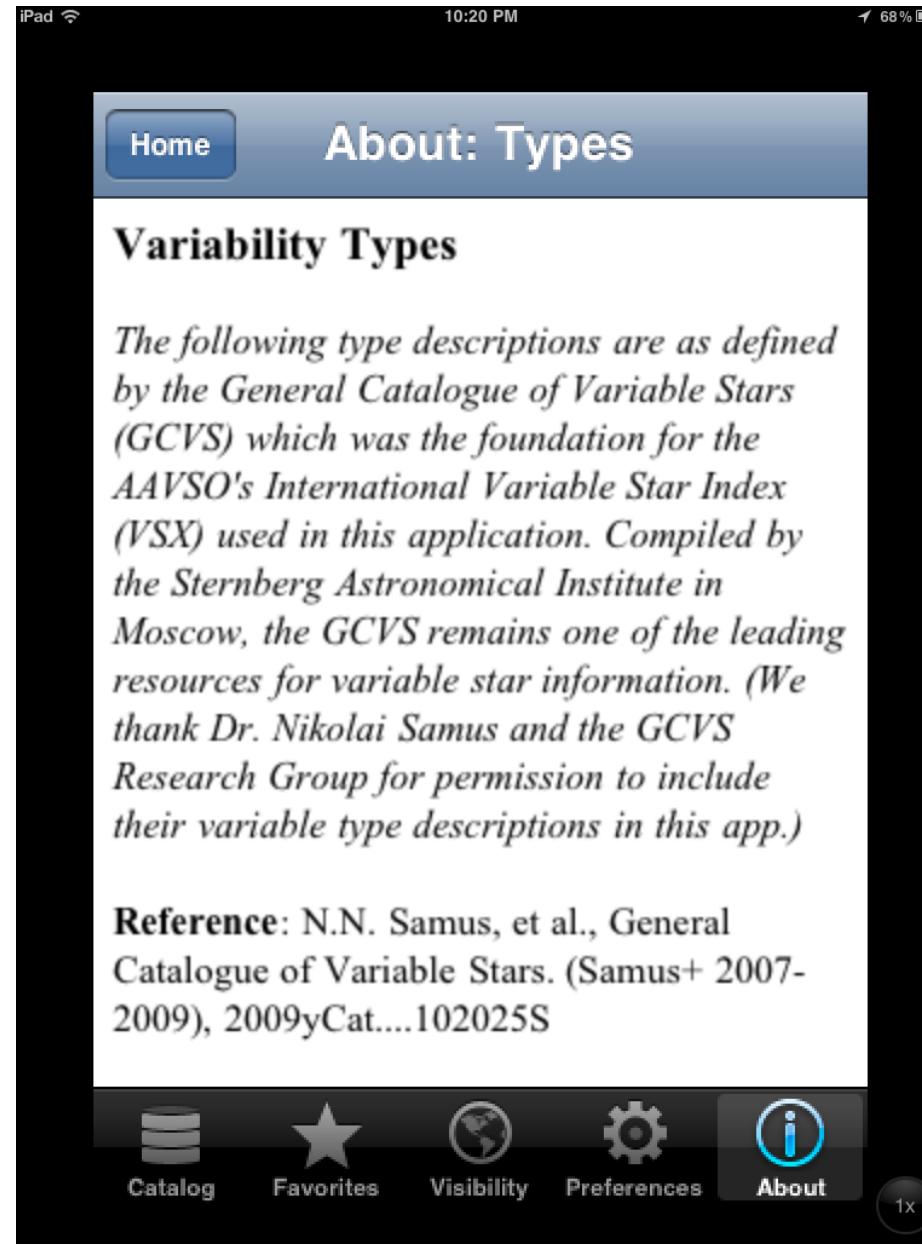
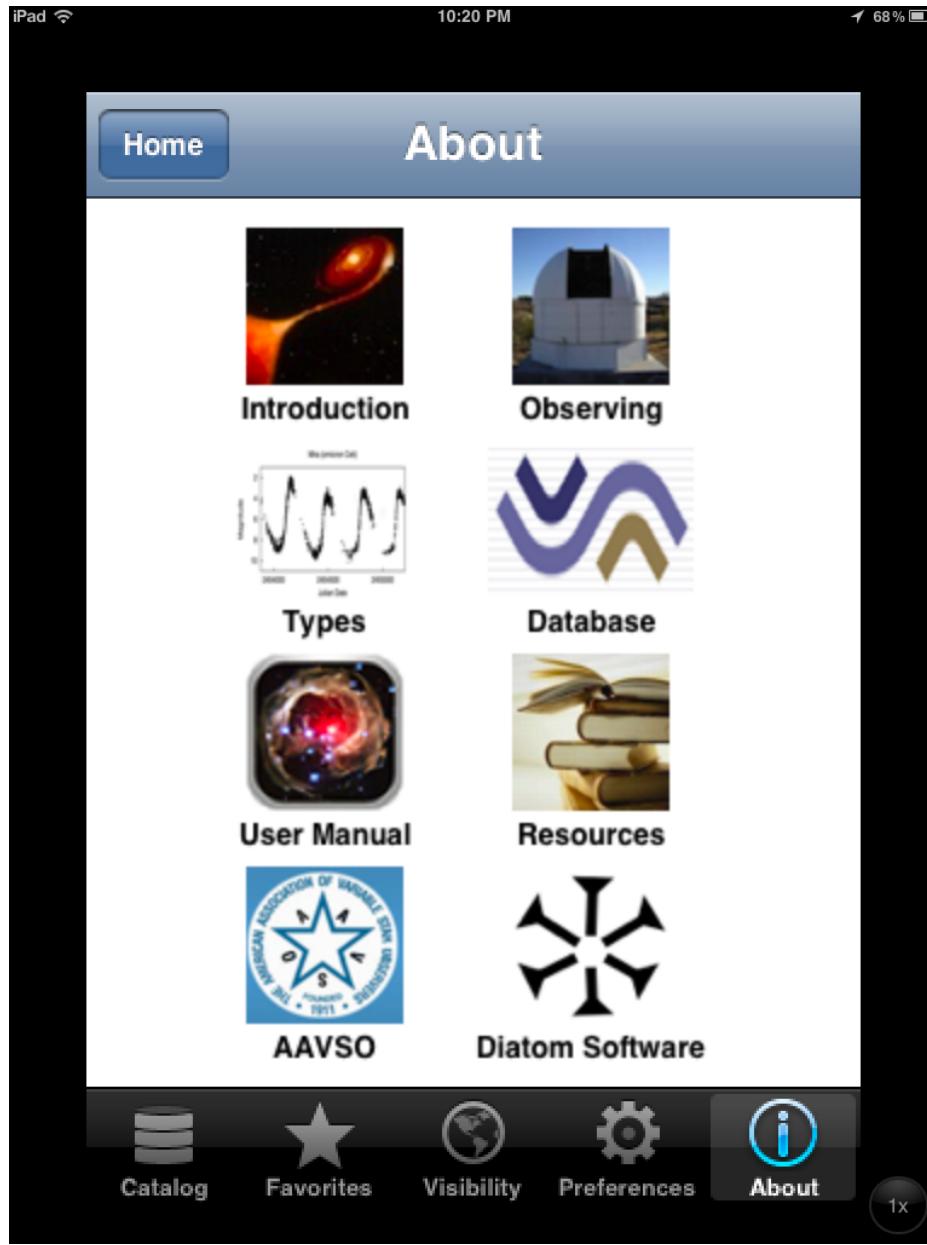
Query by [Constraints](#) applied on Columns (Output Order: + -)

Show Sort Column Clear Constraint Explain (UCD)

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

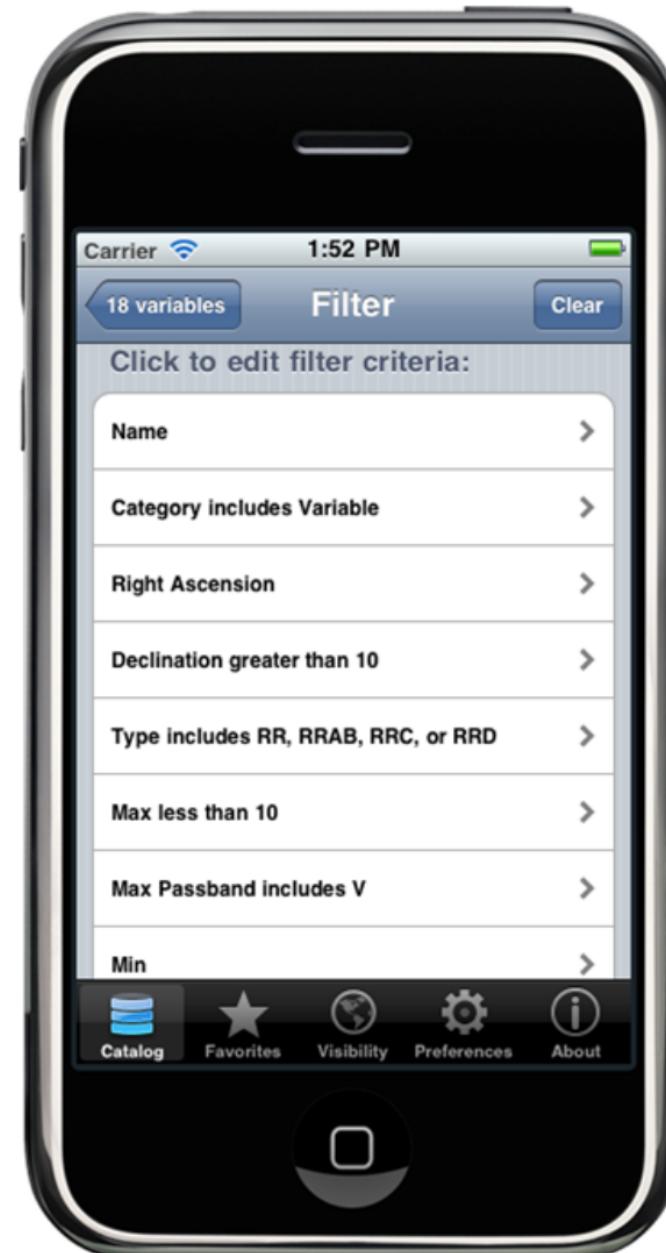
Reset All Clear (n) indicates a possible blank or NULL column Submit





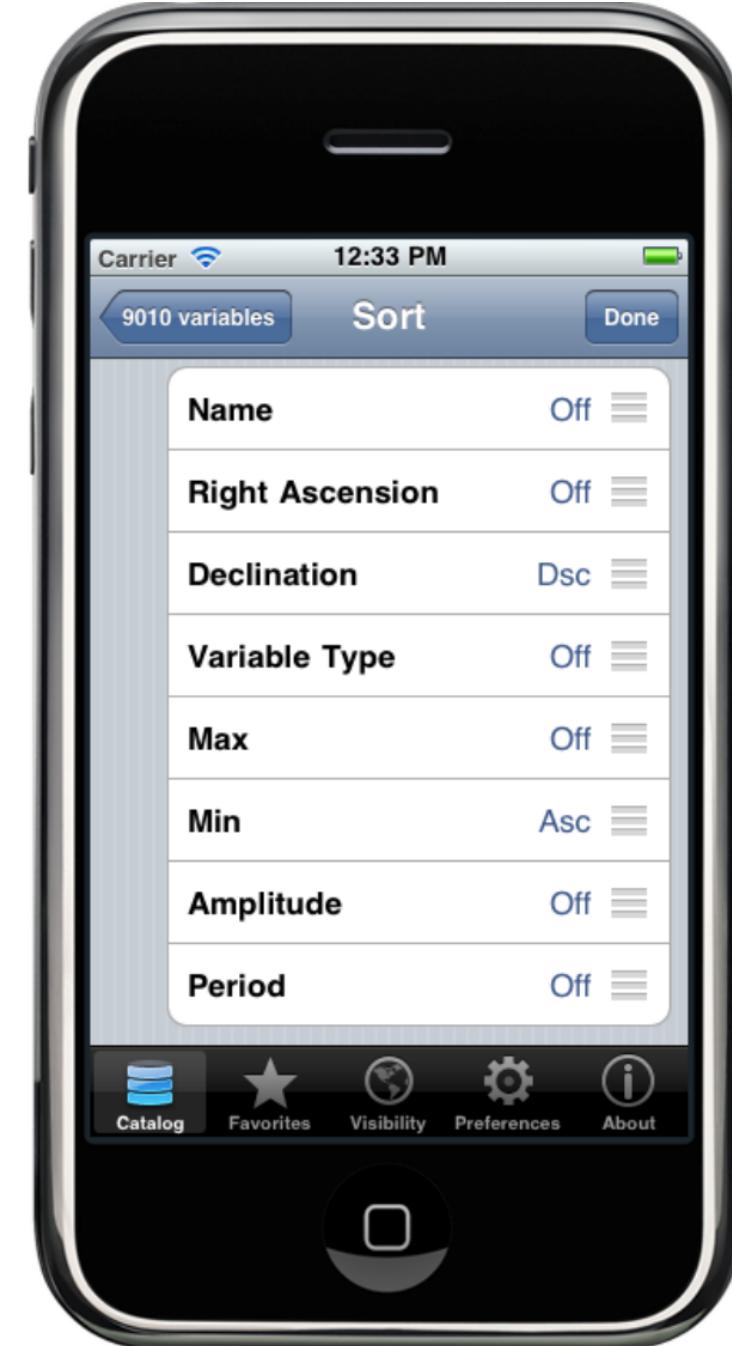
Filtering

- Meta-data defines whether you can filter on a particular column, and how (**Multi-Select, Numeric, Boolean**)
- Number of hits is automatically updated

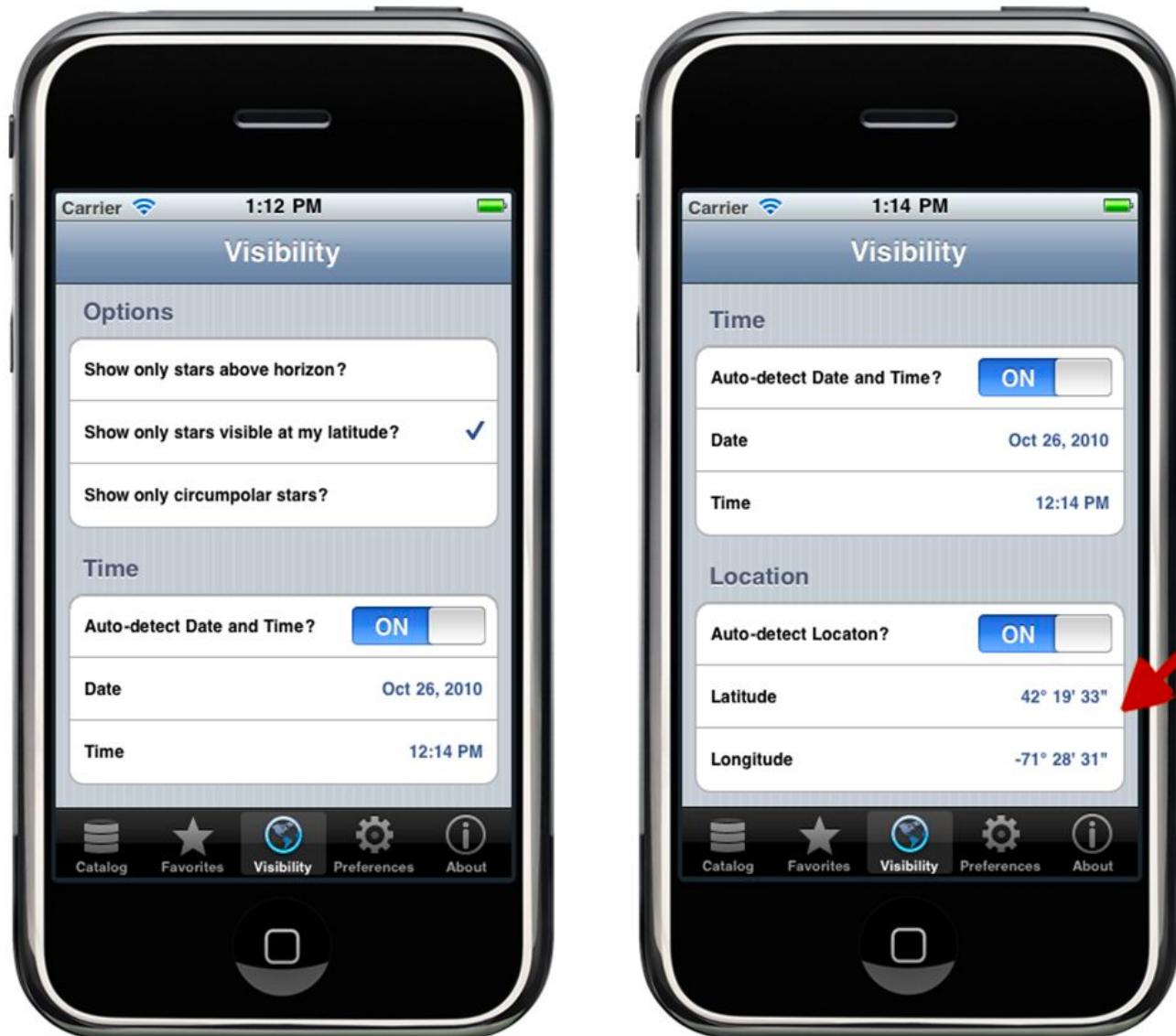


Sorting

- Sortable fields are defined in metadata
- Ascending/Descending/Off
- Drag to reorder



Visibility: Astronomical Extensions

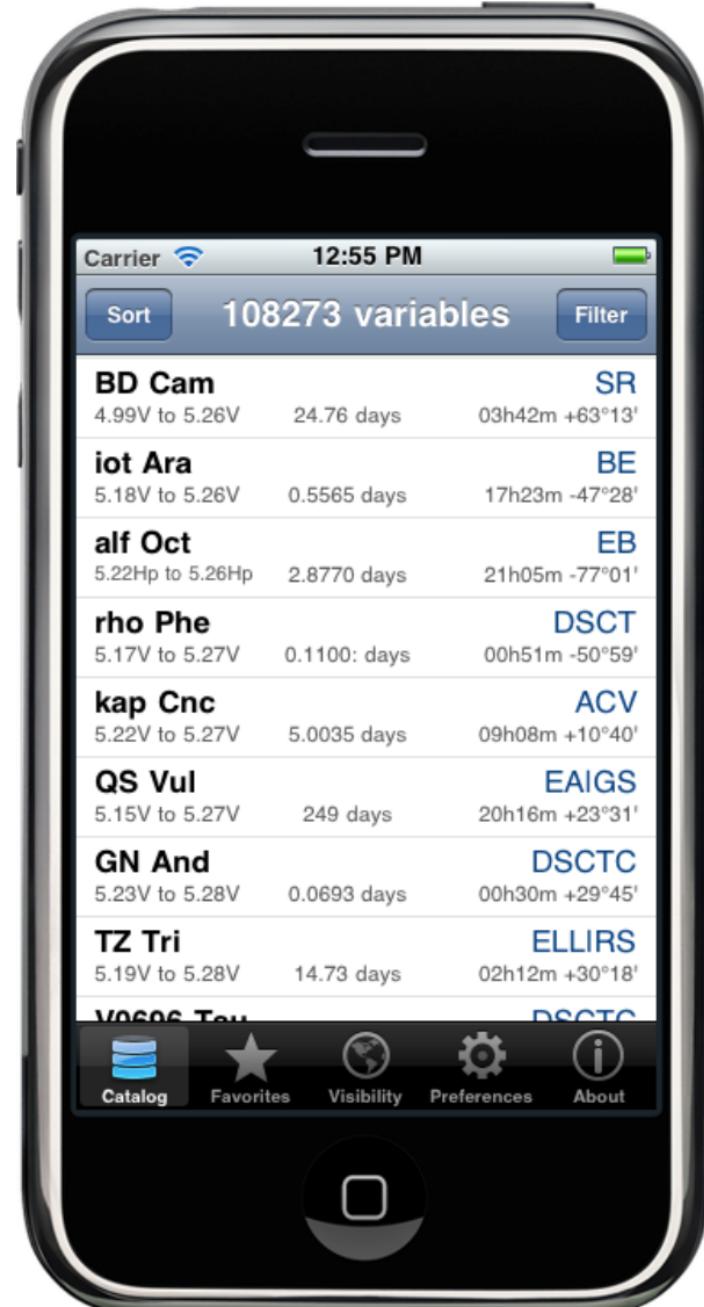


Where to find
me on a clear night!



Viewing matches

- The summary table provides a sorted list of all matching variables
- Key information displayed: name, type, range, period, position



Project Significance

- Created a metadata-driven framework for querying small to mid-sized datasets on the Apple iOS platform
- Provided research support for variable star observers and amateur astronomy enthusiasts. This citizen science effort, in turn, supports professional research in astrophysics and cosmology.
- Learned how to build and deploy iOS applications on the Apple Store, and gained insight on the market demand for free vs. paid apps. (Free apps get 10-100x more downloads!)

