Time Series and the VO

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Why Time Series?

Projects:

Project	Coordinator	Status
ObsTap	David Schade	monitoring implementation
SED Builder	Evanthia Hatziminaoglou and Paolo Padovani	
Search for Classes/List of Objects	Mark Allen	monitoring implementation

Projects in Development:

Project	Status	
Time Series	Collecting use cases and collating existing information	Use Case development page
Radio Astronomy	Collecting use cases	Use Case development page

IVOA Committee on Science Priorities. The primary objective of the CSP "is to identify research needs of the worldwide astronomy community than can benefit from VO related tools and services, and to take action within the context of the IVOA to assist in placing such tools and services into the research community."

Why Time Series?

Motivation I: There are many.

- The number of time series has enormously increased in the last years.

Motivation II: They are important.

- Time domain science encompasses every area of astronomy, from Solar System to cosmology.

Motivation I

Time Series everywhere

SuperWASP

>17 million light curves

The All Sky Automated Survey

> 10 million objects

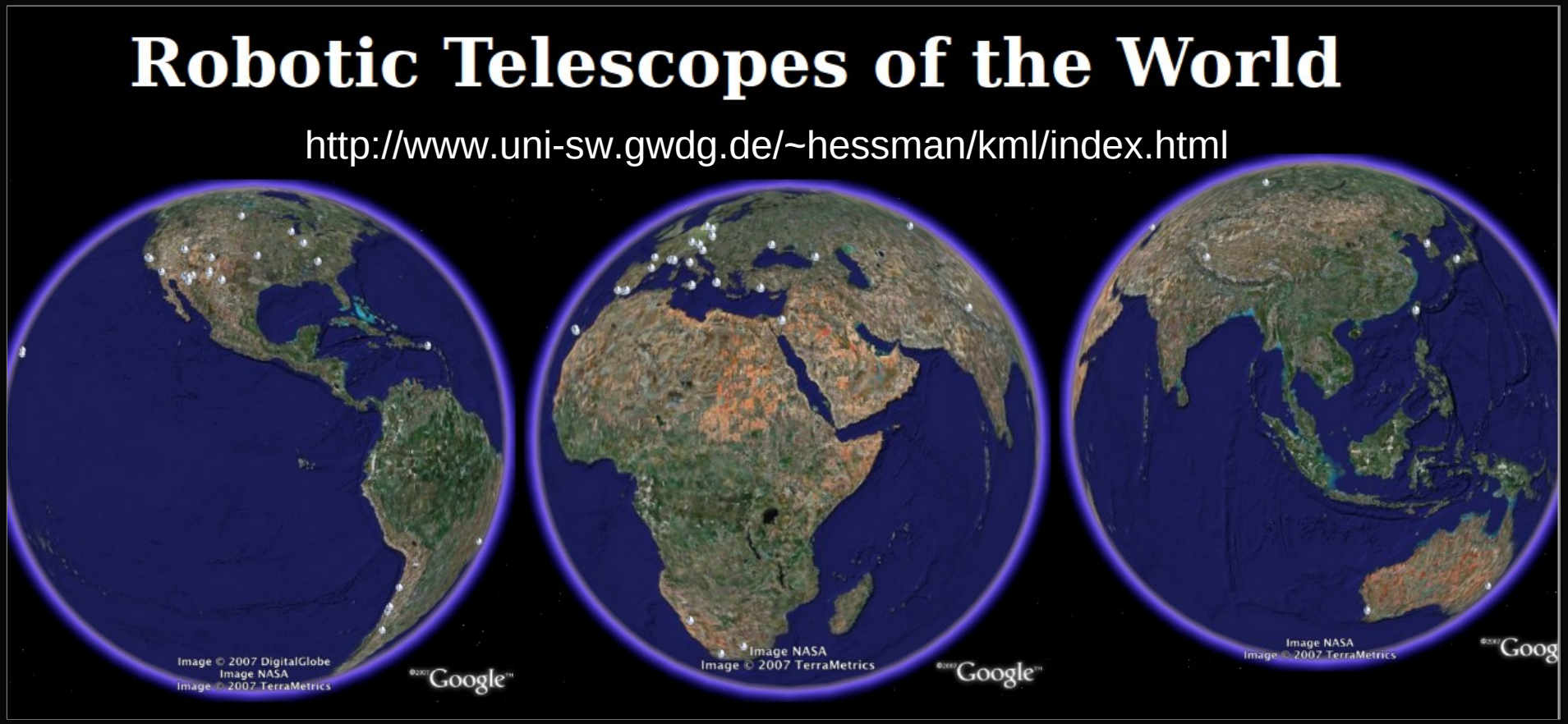
OGLE

> 40 million objects

Pan-STARRS

Time Series everywhere

- Ground-based projects (II)



128 Robotic Telescope Projects

Time Series everywhere

- Ground-based projects (III): The future

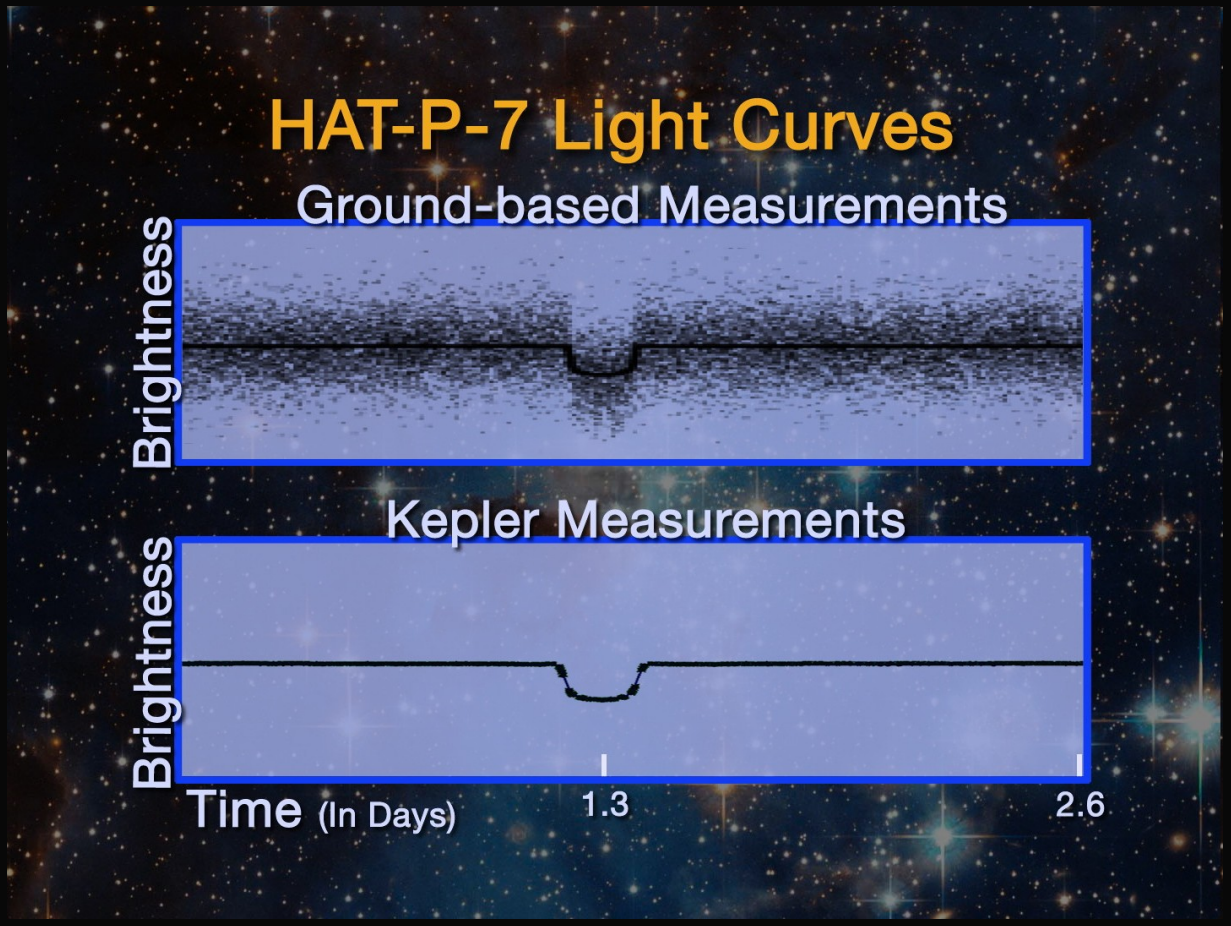
- A 3.2 gigapixel, 15-second exposure image every 20 seconds.
- 200000 images (1.28 PB/y).

Time Series everywhere

Space-based projects:

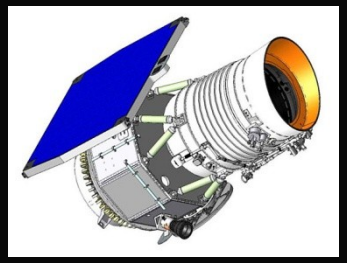
- ✓ Unprecedent photometric accuracy and time sampling.

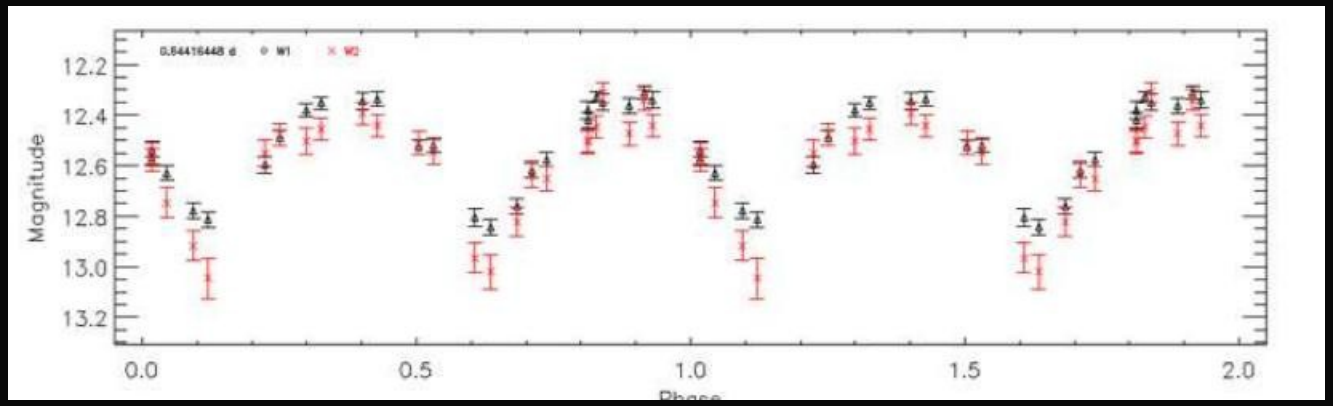
CoRoT, Kepler



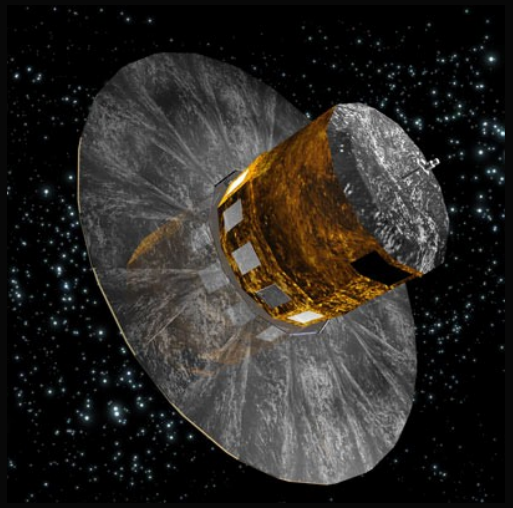
Time Series everywhere

- Space-based projects (III):
  - New spectral windows: WISE





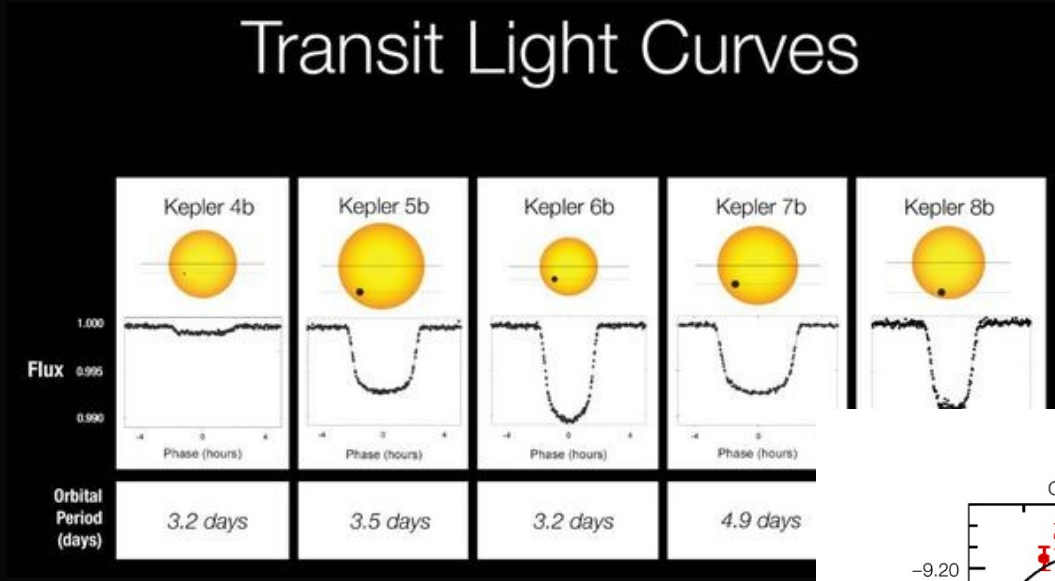
- The future: Gaia
  - ✓ Multi-epoch, multi-color photometry for 10^9 sources.



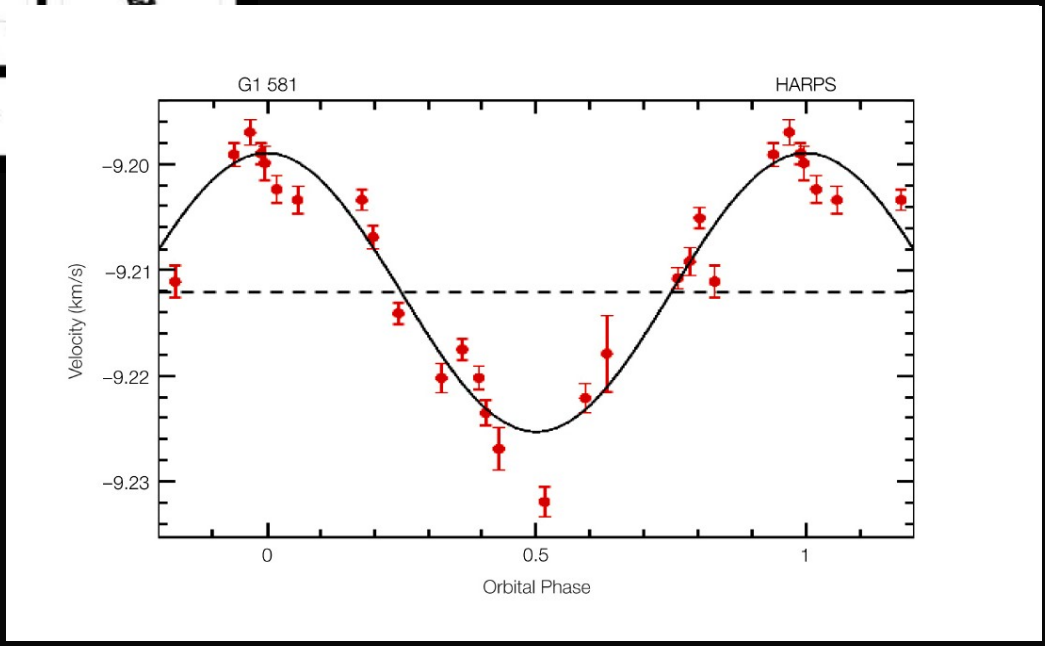
Motivation II

Time Series for everything

- Discovery and characterization of extrasolar planets



Radial velocity



Time Series for everything

Asteroseismology

A&A 435, 955–965 (2005)
DOI: 10.1051/0004-6361:20042480

Astronomy & Astrophysics

Detection of 75+ pulsation frequencies in the δ S

Abstract Extensive photometric mu
200[illegible], 926 h of photometry [illegible]t the mi
excell[illegible]t frequency resolution and hig
record for this type of star. The modes

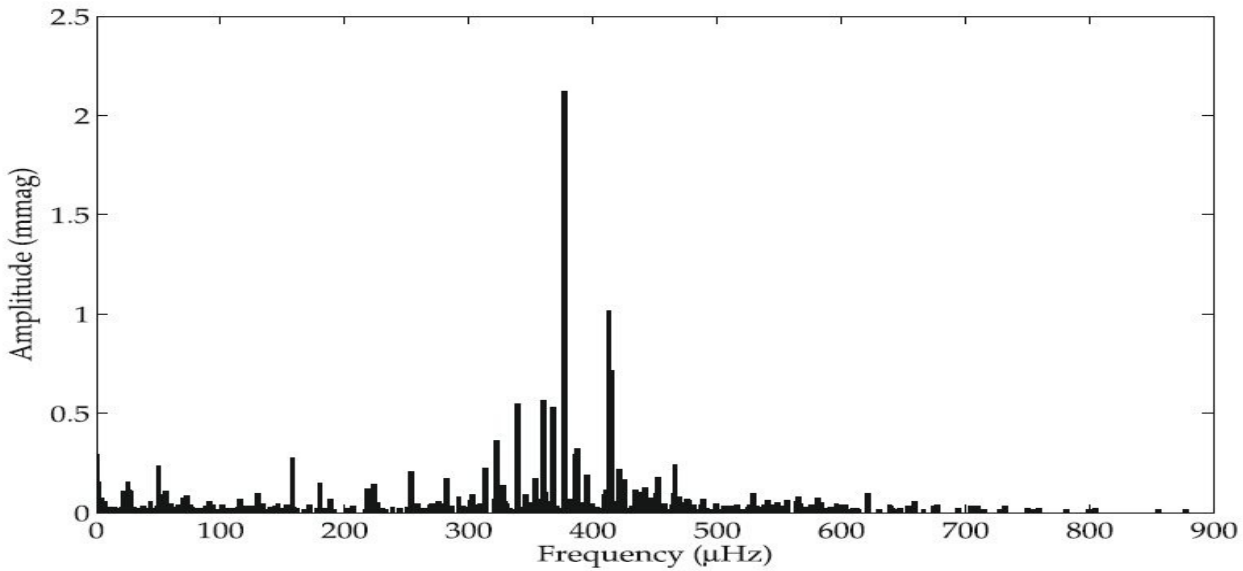
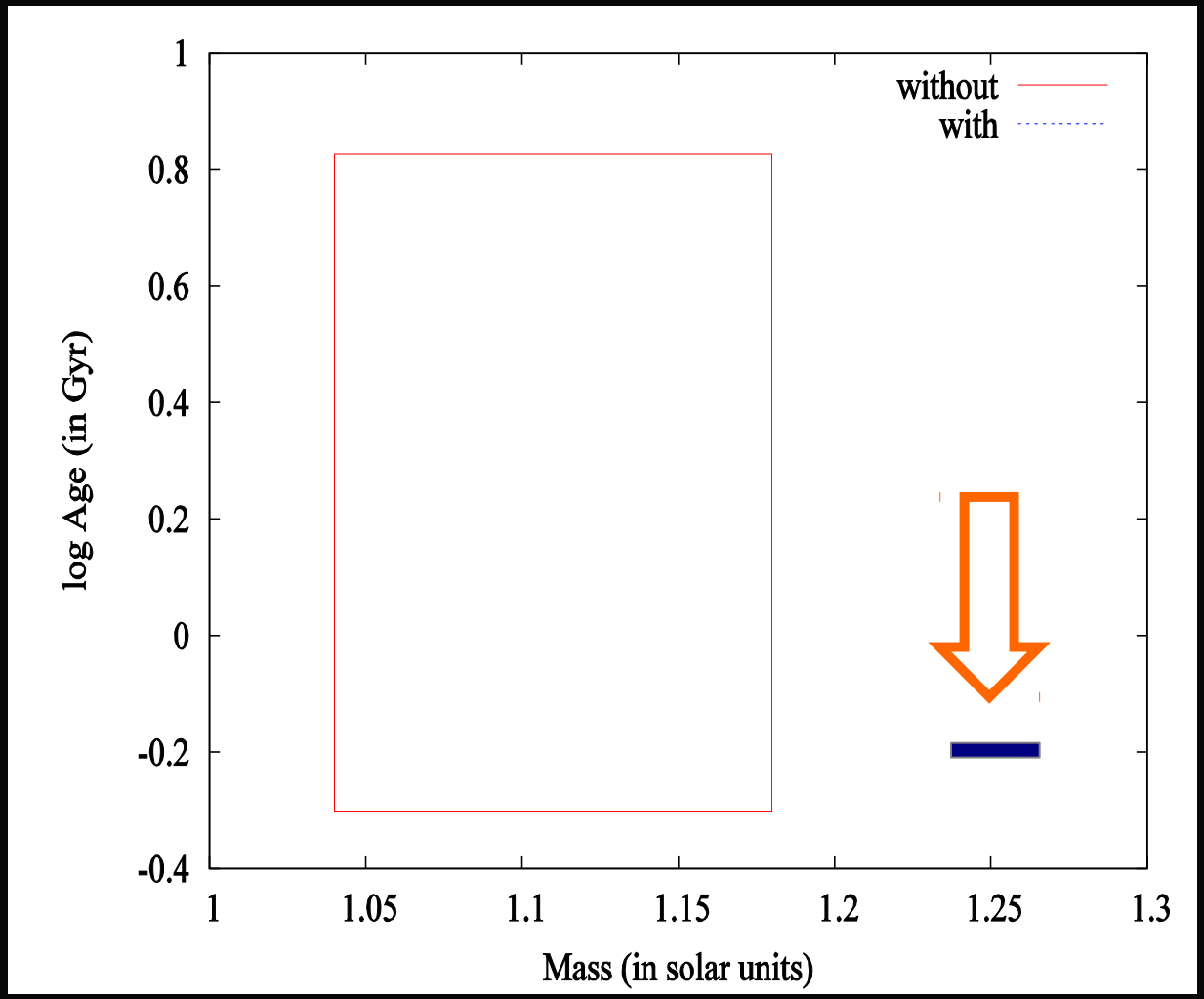


Fig. 2. The 422 frequencies exctracted for HD 174936.

Time Series for everything

- Asteroseismology



Main conclusion:

Time series are important and should be published in the VO.

Use cases

Group B:

- **Common requirement: Combine photometry and light curves of a given object/list of objects in different photometric bands**

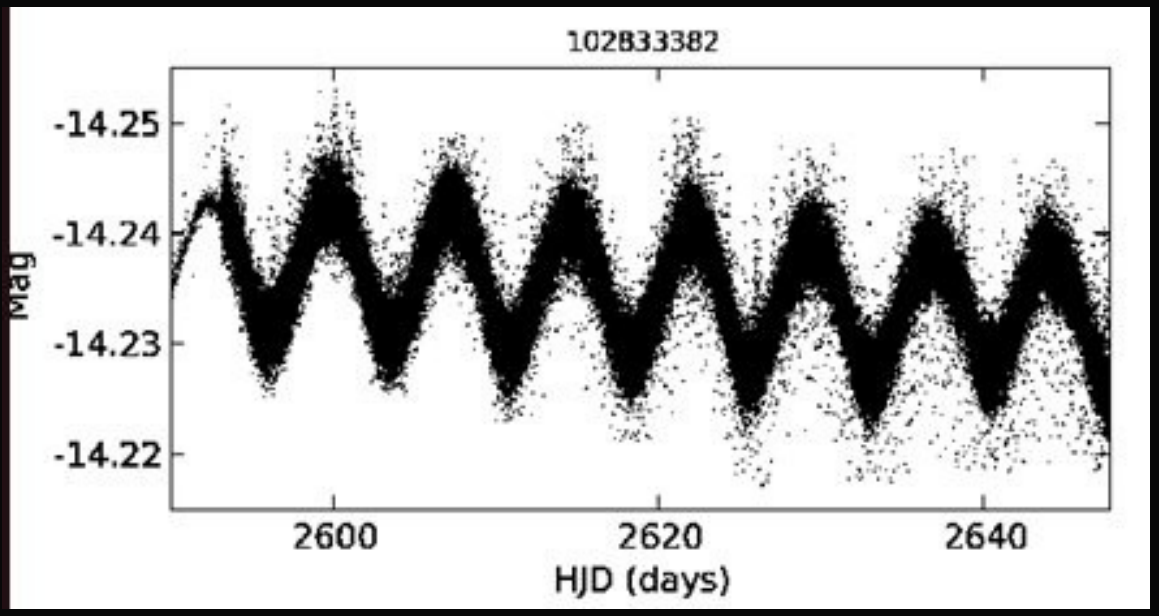
- Use Case #5: Follow-up characterisation of supernovae (based on Zhang et al. arXiv:1208.6078v1)
  - Description: Light curves at different wavelength provide different information allowing a better understanding of the physical processes related to the supernovae explosion.
  - Requirements
    - Combine photometry and light curves of a given object in the same photometric band. Repeat this for all the available bands.
    - Show me a list of data that satisfies
      - Target= SN 2010JL
      - Datatype= Photometry or TimeSeries/lightcurves
      - Axes include time
      - Axes include brightness
      - Information on photometric band (zero point, transmission curve of the filter)

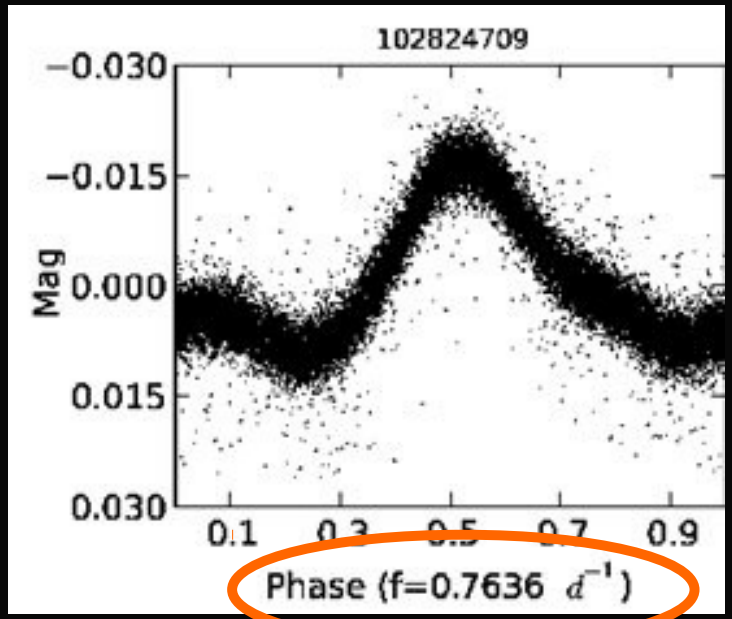
Group C:

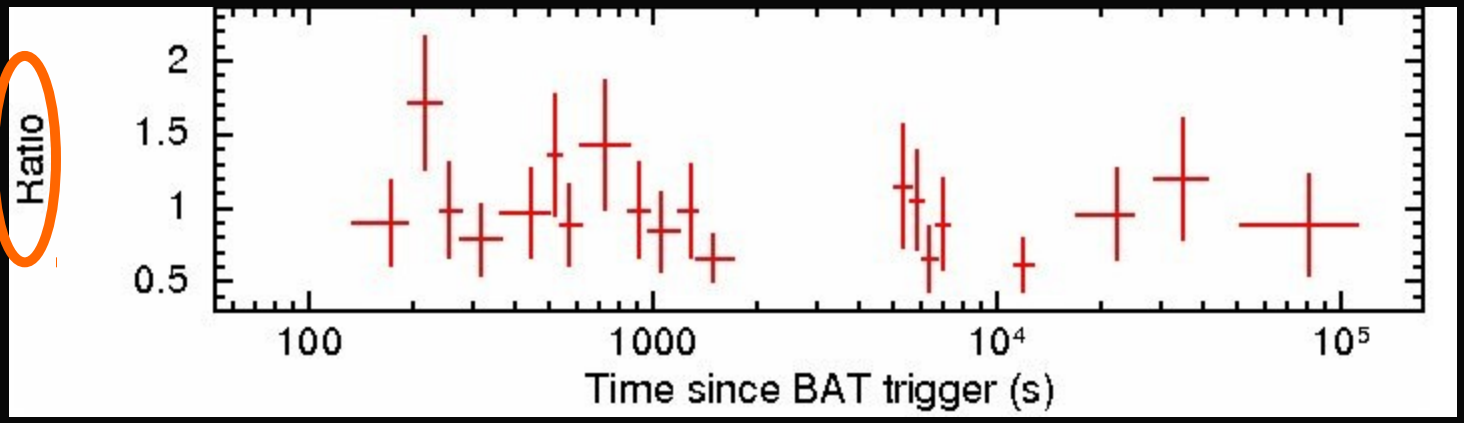
- **Common requirement: Time series other than light curves**

Use cases

- No canonical representation for Time Series







Use cases

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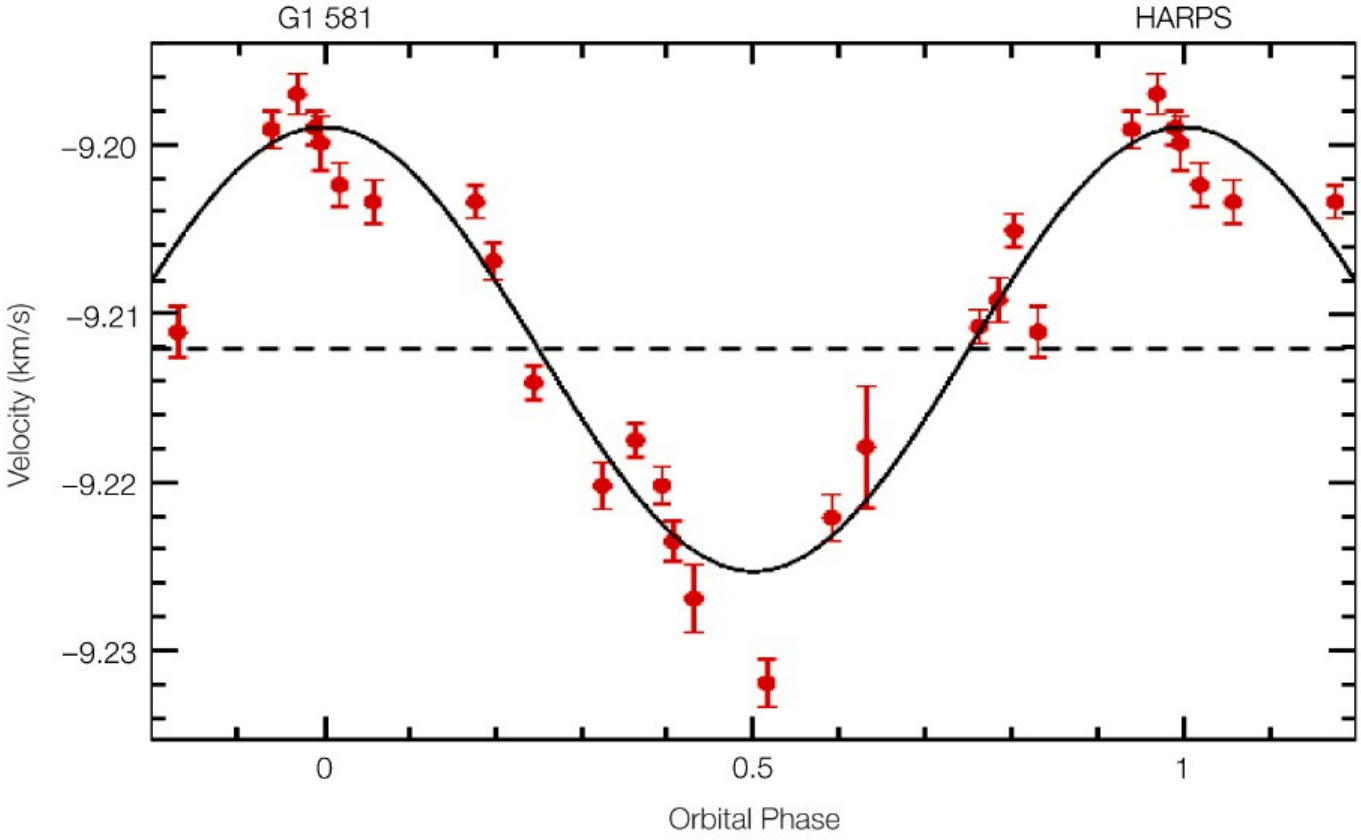
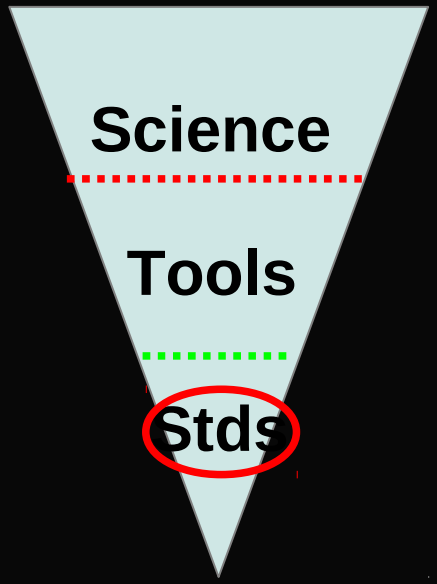


VO standards and Time Series

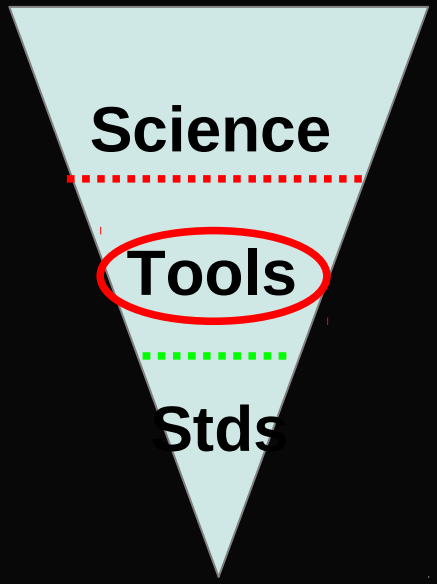


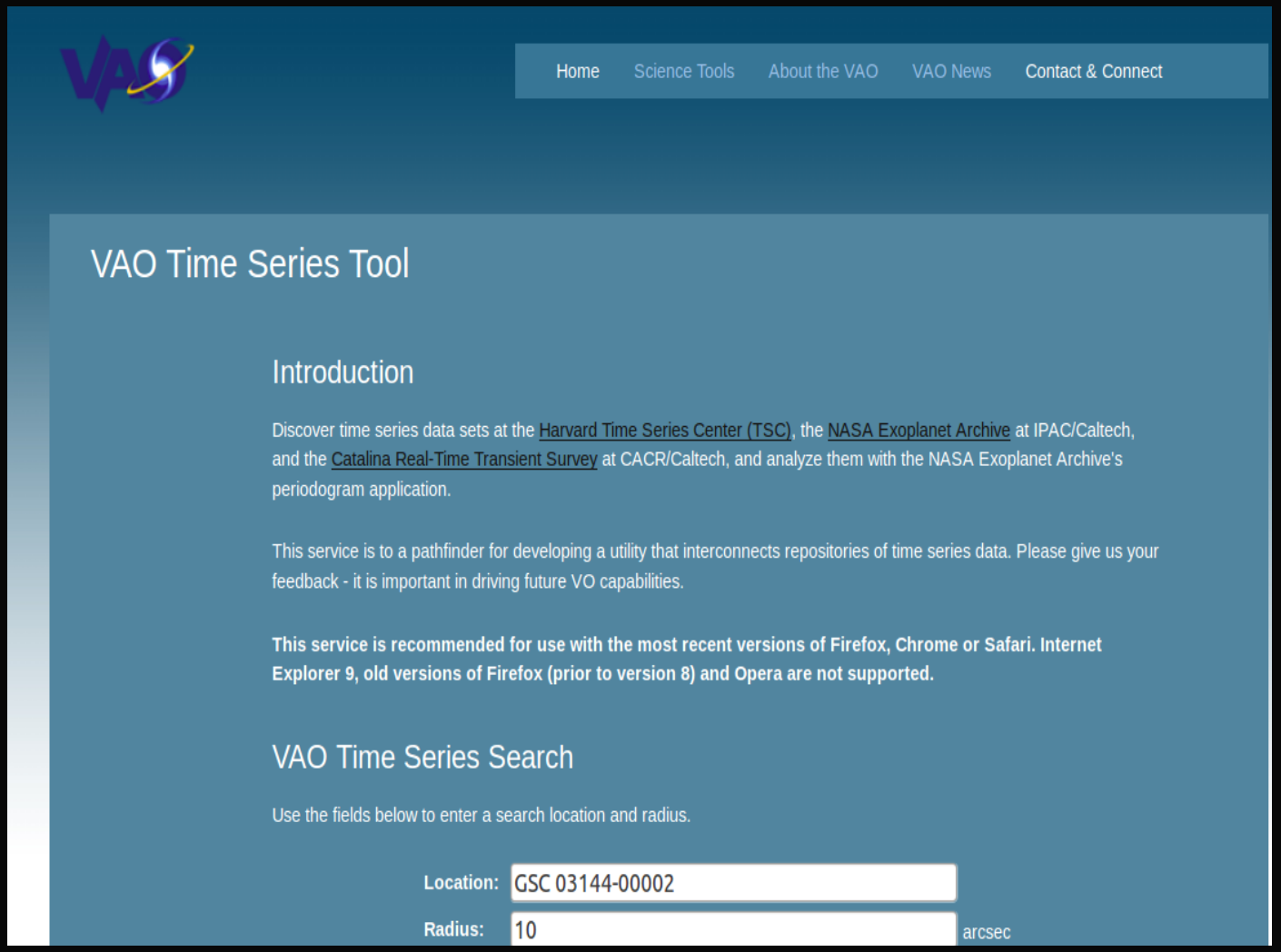
Session #2: Future of Data Discovery - Tuesday 16:30 - 18:00

topic	speaker	time
Time Series in the VO	Raul Gutierrez Sanchez	15 min

Data discovery	•Registry
Data access	•SSAP •IVOA note on 'Time Series Data' (Dec 2010) •ConeSearch •TAP
Data model	•SDM •SDM 2.0 •.Astro SimpleTimeseries •IVOA note on 'Time Series Data' (Dec 2010)

VO tools and Time Series





Summary

- Time Series are important.
- We (VO) are really late and we have to react fast.
  - The VO publication of (at least the simplest cases of) Time Series should be a reality soon.