



ERLANGEN CENTRE
FOR ASTROPARTICLE
PHYSICS



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The Bamberg photographic plate archive

The digitizing project

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- observational astronomy
 - today: CCD detectors
 - ≥ 20 years ago: photographic emulsions (mainly on glas plates)
- plate archives
 - Sonneberg (250.000), **Bamberg (40.000)**, Hamburg (35.000), Heidelberg (15.000), Bonn (11.000), Postdam (9.000)
- Bamberg Southern Photographic Patrol Survey (Strohmeier 1963)
 - Boyden, South Africa, 1963-1976, aim: search for variable stars
 - direct images, $B \leq 14.5\text{mag}$, $16\text{cm} \times 16\text{cm} = 14^\circ \times 14^\circ$
 - **all southern data from this time is primarily based on this survey**

■ historian's point of view:

- oldest plates at Bamberg from 1910s
- photographic emulsions already begin to decompose and dissolve from their glass plates

■ scientist's point of view:

- former results using blink comparators:
 - 1.700 'Bamberg variables'
 - (e.g. Strohmeier & Knigge 1961, Friedrich & Schöffel 1971, Knigge & Sosna 1977)
- only a fraction of observed plates have been looked on
- 25.000 - 200.000 stars on one plate
 - just 'tip of the iceberg'

Need for Preservation



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- equipment became affordable
 - large amount of storage space
- give access to the community (Virtual Observatory)

⇒ **digitizing project** (DFG funded)

in collaboration with the Leibniz Institute for Astrophysics at
Potsdam (AIP) and the Hamburg Observatory

Metadata



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■ 11 years ago:

start of project to incorporate all
metadata into Wide-Field Plate
Database (WFPDB)

(Tsvetkov et al. 2005,
Tsvetkova et al. 2006)

→ www.skyarchive.org

WFPDB search page

1

Wide-Field Plate Database - Sofia Search Page

WFPDB WFPDB@VizieR Aladin All WFPDB Archives Active WFPDB Archives

Query Setup
Maximum entries per page: 50 Output layout: html table Output order: + - Reset A

Search by Object or Field Coordinates
RA J2000 hh mm ss Star Gazer Visualization
DEC J2000 dd mm ss
Field Size deg Radius Box Size
 Instrument Field
 Reduced Instrument Field

More constraints
 Plates with previews only Magnitude Limit

Additional display
Angular Distance from Field Centre Preview (if available) JD

Select A Submit Clear

Search by Constraints applied on Columns

Show	Sort	Column	Constraints	Units	Explain
<input checked="" type="checkbox"/>	<input type="checkbox"/>	IDObs	eam	(char)	WFPDB observatory identifier
<input checked="" type="checkbox"/>	<input type="checkbox"/>	IDIns	010	cm	Instrument aperture
<input checked="" type="checkbox"/>	<input type="checkbox"/>	IDSuf1		(char)	Instrument aperture suffix
<input checked="" type="checkbox"/>	<input type="checkbox"/>	IDno			Original plate number
<input checked="" type="checkbox"/>	<input type="checkbox"/>	IDSuf2		(char)	Original plate number suffix
<input checked="" type="checkbox"/>	<input type="checkbox"/>	RAJ2000		hh mm	Right ascension
<input checked="" type="checkbox"/>	<input type="checkbox"/>	DECJ2000		dd mm	Declination
<input checked="" type="checkbox"/>	<input type="checkbox"/>	CCOD			Code for Error, Missing Data, or Uncertainty of coordinates
<input checked="" type="checkbox"/>	<input type="checkbox"/>	DATE/UT		YYYY MM DD HH:MM:SS	Date, time of observation
<input checked="" type="checkbox"/>	<input type="checkbox"/>	TCOD			Code for Error, Missing Data, or Uncertainty of observation time
<input type="checkbox"/>	<input type="checkbox"/>	OBJNAM		(char)	Object or field designation
<input type="checkbox"/>	<input type="checkbox"/>	OBJTYP		(char)	Object type code
<input type="checkbox"/>	<input type="checkbox"/>	METHOD			Method of observation code
<input type="checkbox"/>	<input type="checkbox"/>	MULTEX			Multiplicity of exposure
<input type="checkbox"/>	<input type="checkbox"/>	EXP		min	Exposure time
<input type="checkbox"/>	<input type="checkbox"/>	EMULS		(char)	Emulsion type
<input type="checkbox"/>	<input type="checkbox"/>	FILT		(char)	Filter type
<input type="checkbox"/>	<input type="checkbox"/>	SPEC		(char)	Spectral band
<input type="checkbox"/>	<input type="checkbox"/>	DIMx			X dimension of plate
<input type="checkbox"/>	<input type="checkbox"/>	DIMy			Y dimension of plate
<input checked="" type="checkbox"/>	<input type="checkbox"/>	PQUAL			Link to quality information
<input checked="" type="checkbox"/>	<input type="checkbox"/>	PNOT			Link to note text
<input checked="" type="checkbox"/>	<input type="checkbox"/>	POBS			Link to observer's name(s)

<http://wfpdb.org/search/>

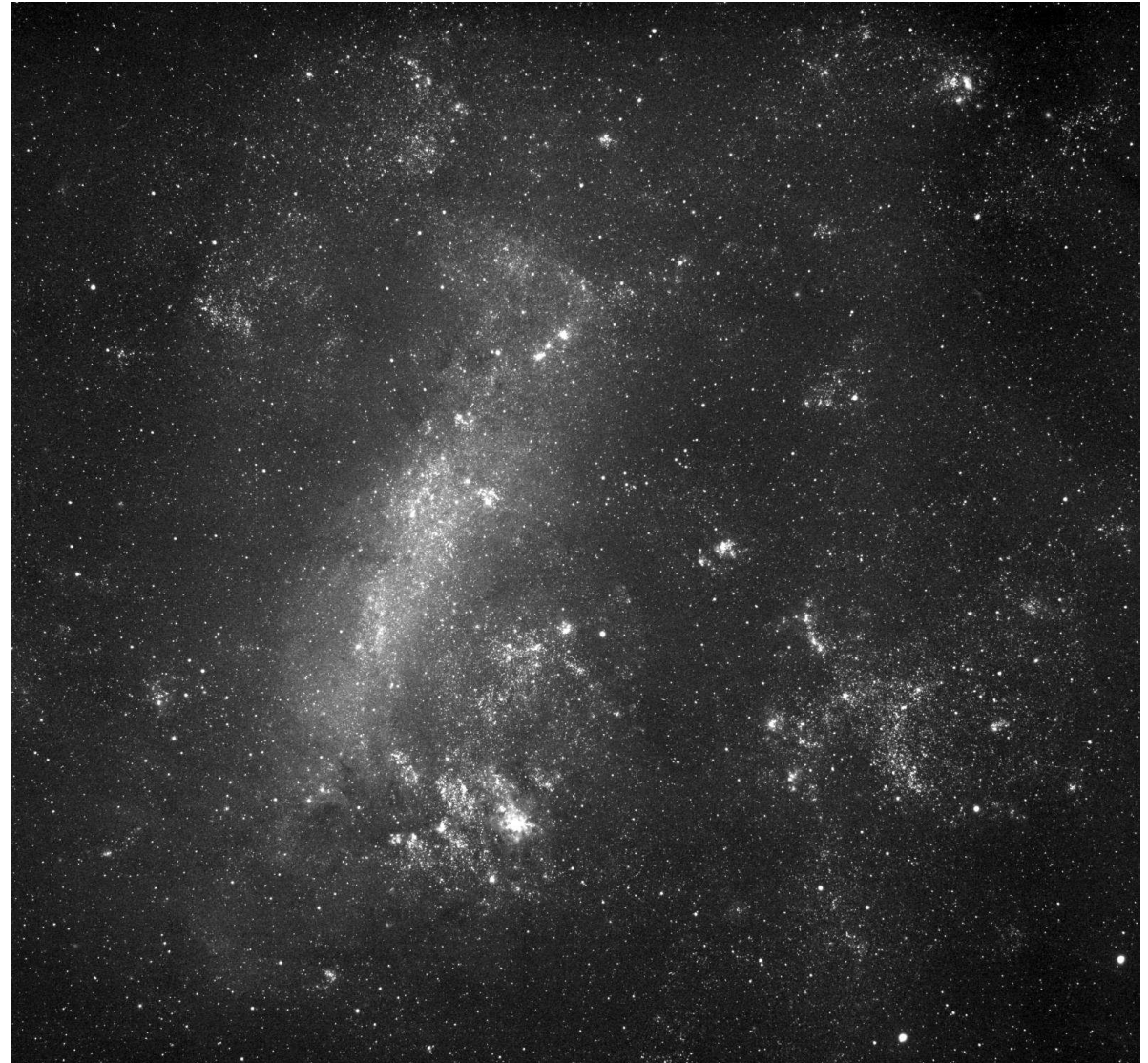
08/22/2013 02:20:12 PM

■ flatbed scanner

EPSON Expression

10000XL

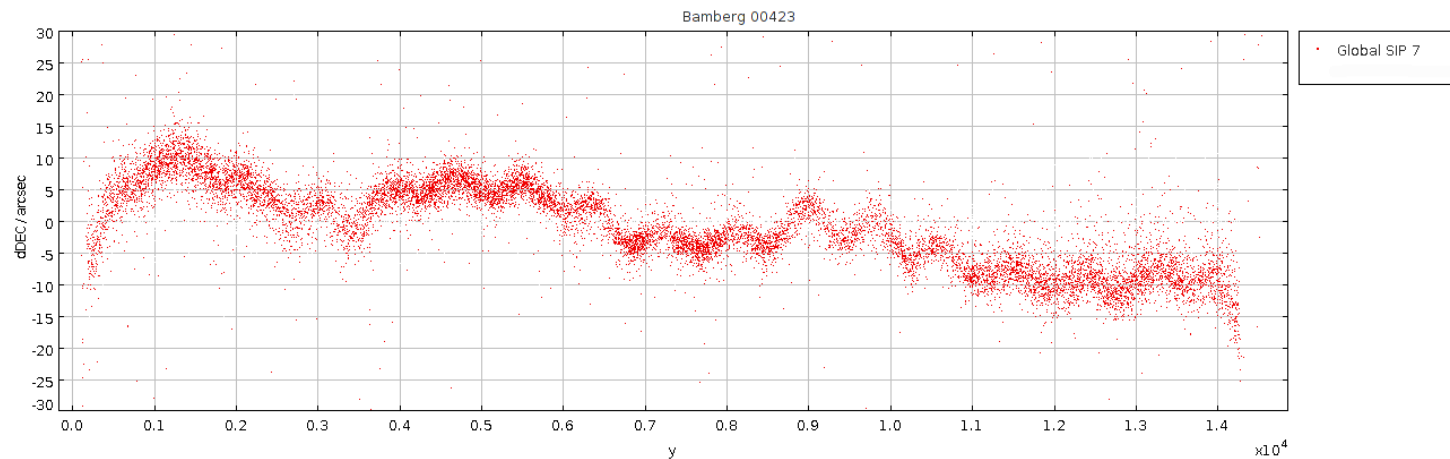
- resolution:
 $2.400 \text{ dpi} = 10 \mu\text{m} = 3''.6/\text{pix}$
- duration: 5 minutes
- size: 400 MByte



- implementation in database (Virtual Observatory)
 - all scanned data (inclusive logbooks) + metadata
 - FITS-header (Wide-Field Plate Database)
 - storage, web based interface
 - Leibniz Institute for Astrophysics at Potsdam (AIP)

- scientific investigations
 - ⇒ **data extraction**
 - astrometry
 - photometry

- SExtractor $\longrightarrow x, y$
- astrometry.net \longrightarrow RA, DEC



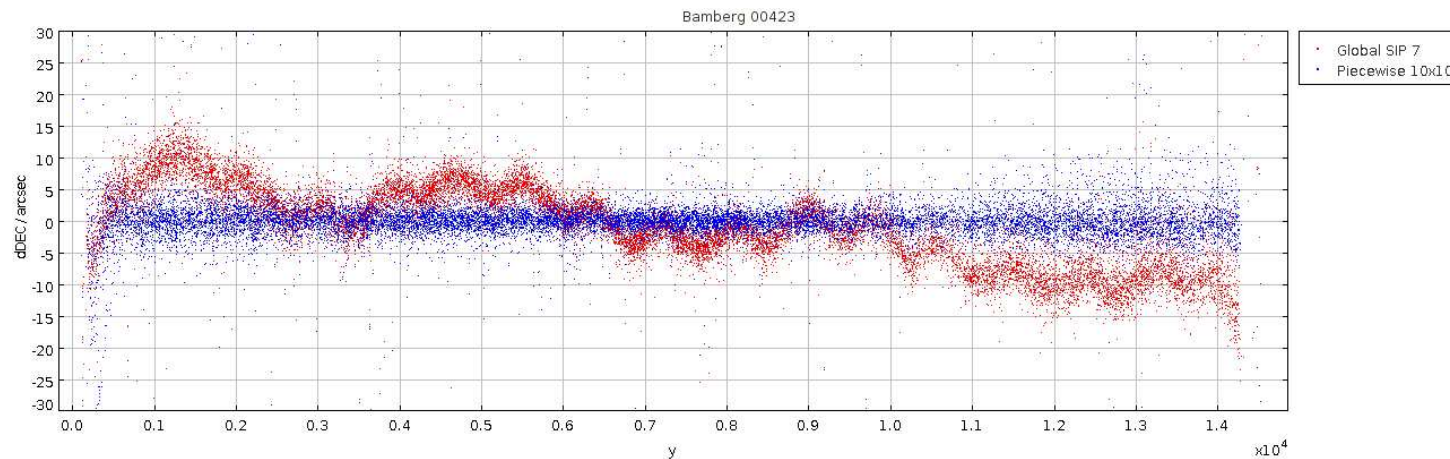
⊕ no additional file

FITS header: Simple Imaging Polynomial (SIP)

⊖ $\langle \text{RA, DEC} \rangle = \pm 15''$

⊖ for good solution \longrightarrow **2** scans necessary

- SExtractor $\longrightarrow x, y$
- astrometry.net, SCAMP + segmentation \longrightarrow RA, DEC



⊕ $\langle \text{RA, DEC} \rangle = \pm 2''$ (note: scan resolution = $3''.6/\text{pix}$)

\longrightarrow less than expected \longrightarrow search for e.g. asteroids, comets

⊕ for good solution \longrightarrow **1** scan necessary

⊖ additional file (source list)

Photometry



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- SExtractor \rightarrow relative magnitudes (using Zero point value)
- calibration: catalogs \rightarrow magnitudes

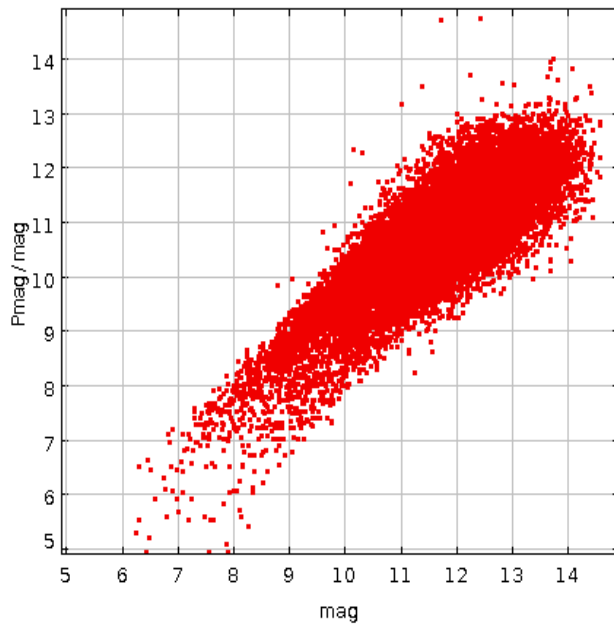


plate vs. HST GSC

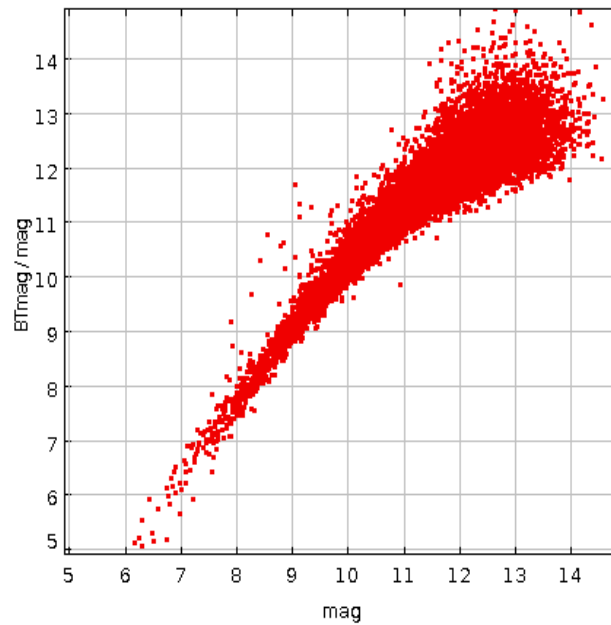


plate vs. Tycho-2

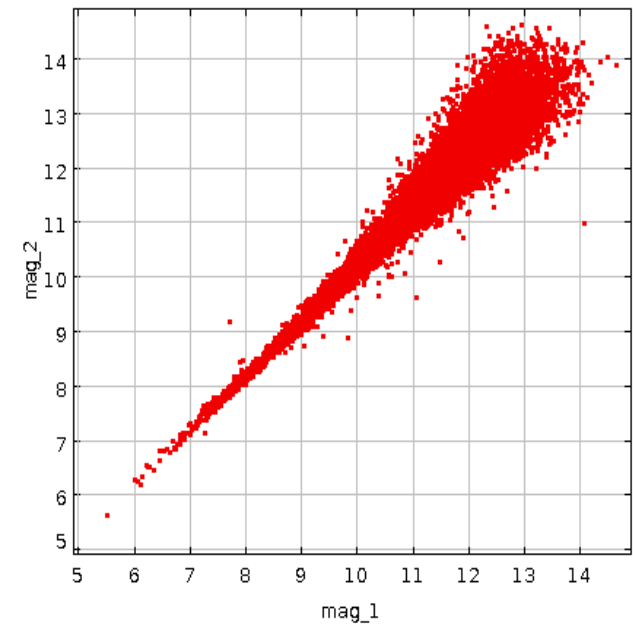


plate1 vs. plate2

Photometry



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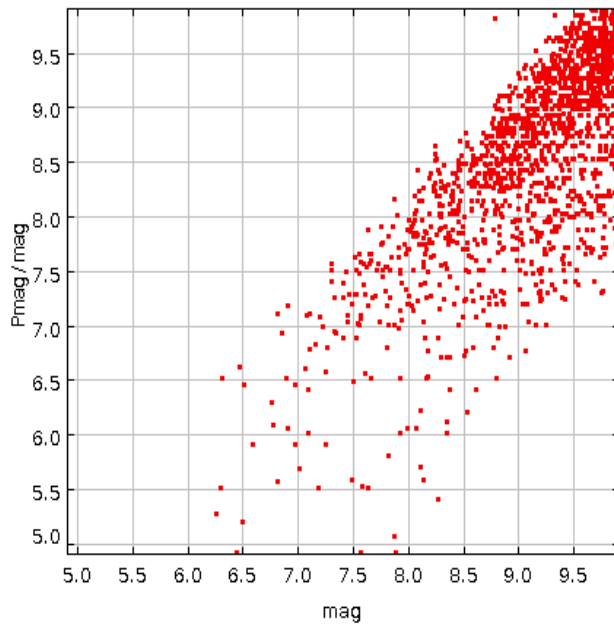


plate vs. HST GSC

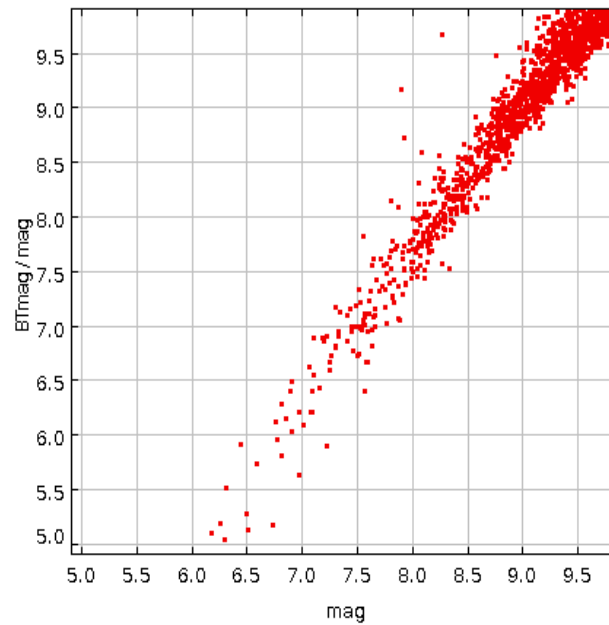


plate vs. Tycho-2

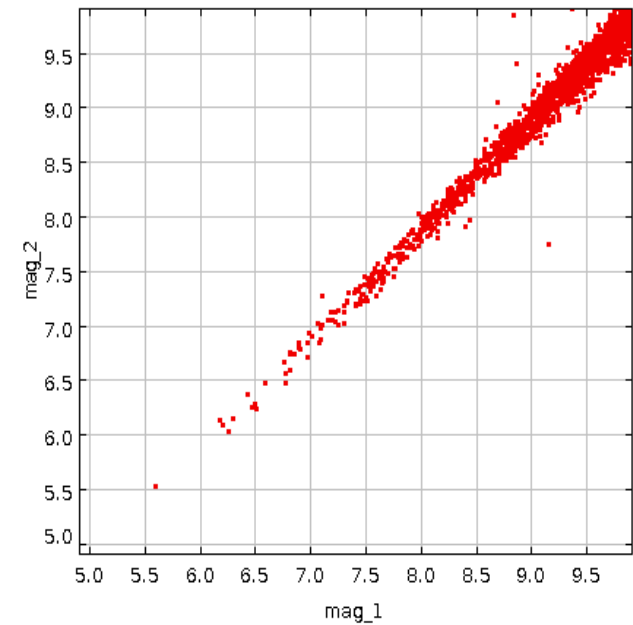


plate1 vs. plate2

First Tests



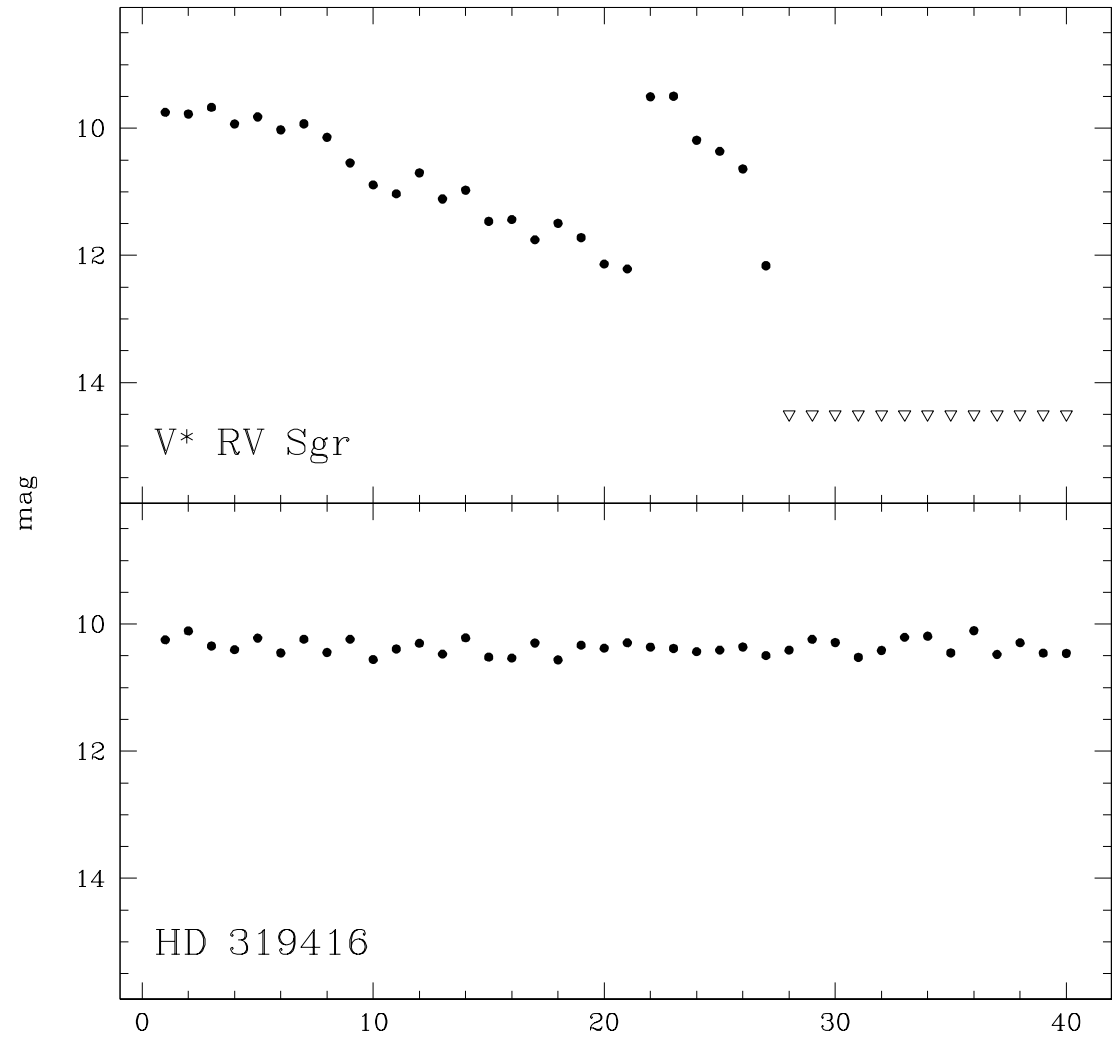
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- known Mira
- $8\text{mag} \leq V \leq 13\text{mag}$



First Tests



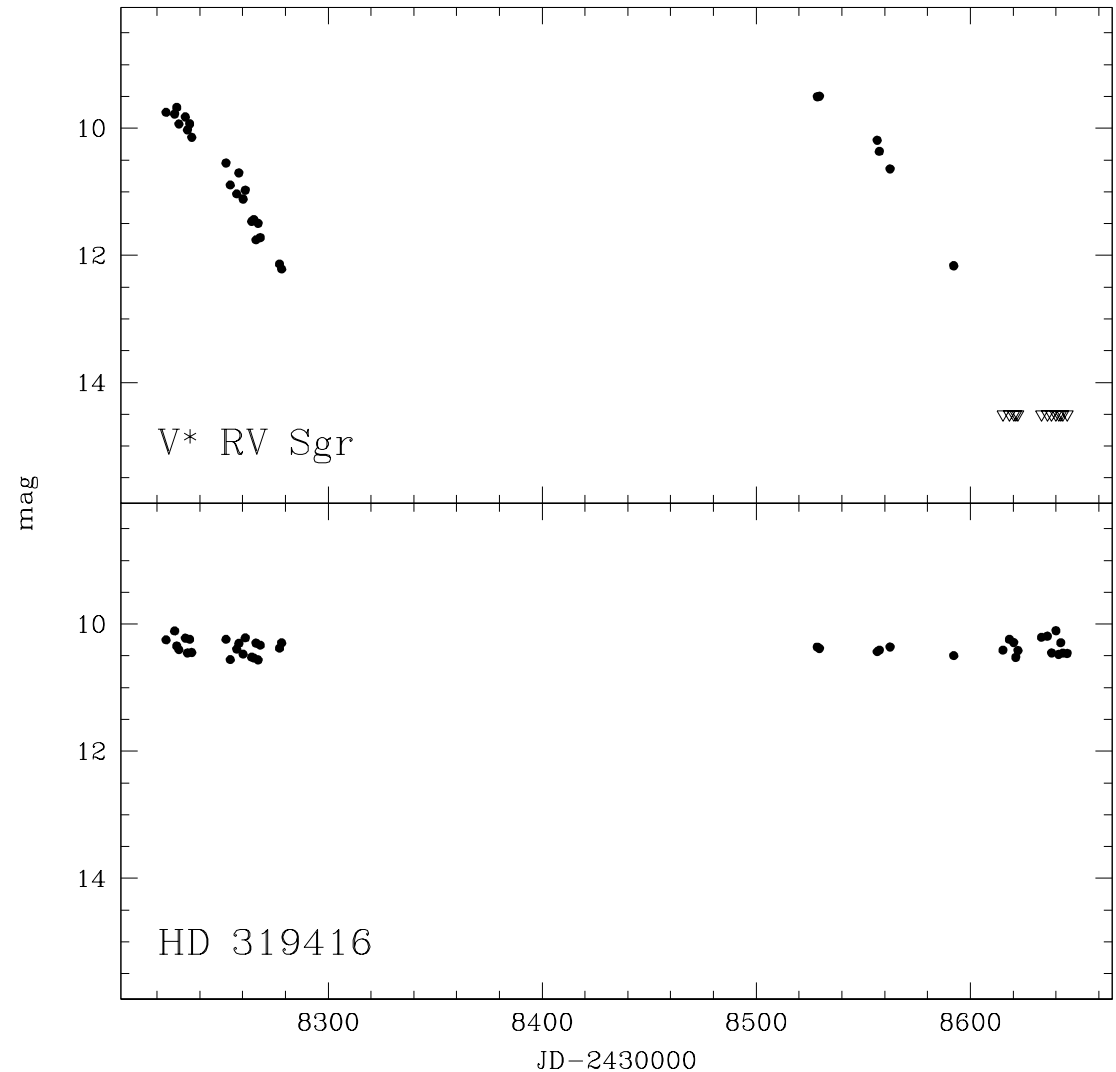
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