

A Scientific Network of Small Robotic Telescopes



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The AAVSO

- Pro-am study of variable stars
- Founded 1911; celebrating 100th anniversary
- International: 1000 members in 45 countries
- 3000 total observers (800 active per year)
- 20 million online observations
- Campaigns, workshops, publications
- Joint AAS/AAVSO meeting May Boston
- <http://www.aavso.org>

AAVSOnet

- 19 telescopes, 6cm to 80cm
- Started in 2005 (Sonoita)
- Goals:
 - Staff research/training
 - Membership access (equip/loc) free!
 - Long-term monitoring
 - Targets of opportunity
 - No customized software

Worldwide distribution of sites



Unique features

- Volunteer-run, donor/vendor funded
- Telescope optimization (small, medium, large, survey)
- Scientific use only (proposals, processed images, transforms). No real-time control
- Heterogeneous telescopes, homogeneous software. Everything commercial
- VOEvent interrupts
- Integrated solution
- Telescope advocates

Astokolkhoz Observatory

Typical site - private property, on-site human supervision

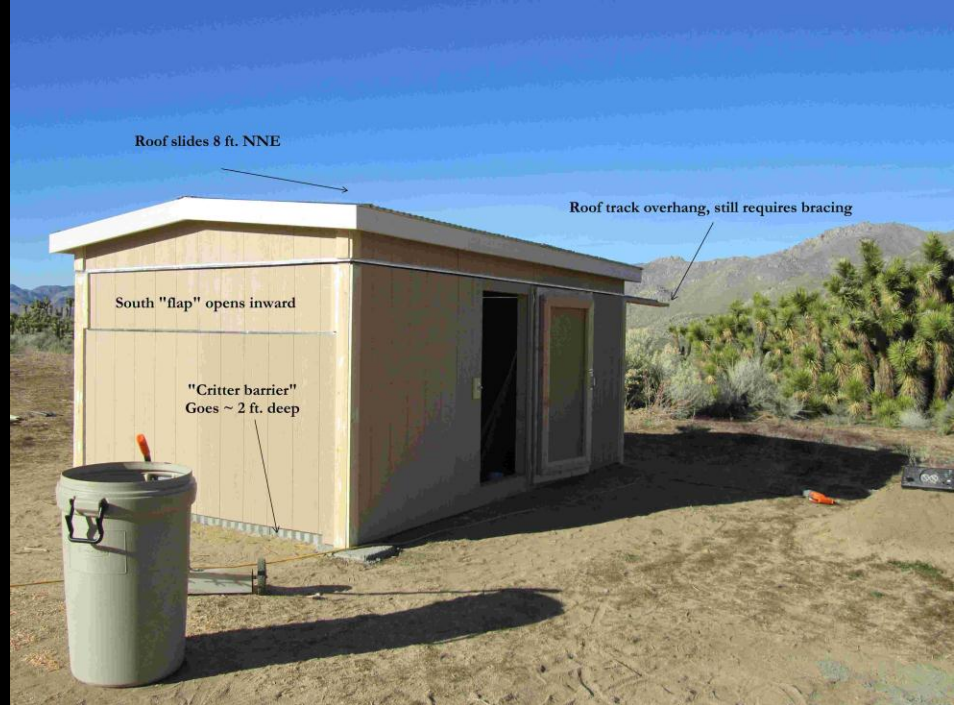


Tom Krajci with BSM_NM



The Bright Star Monitor (BSM)

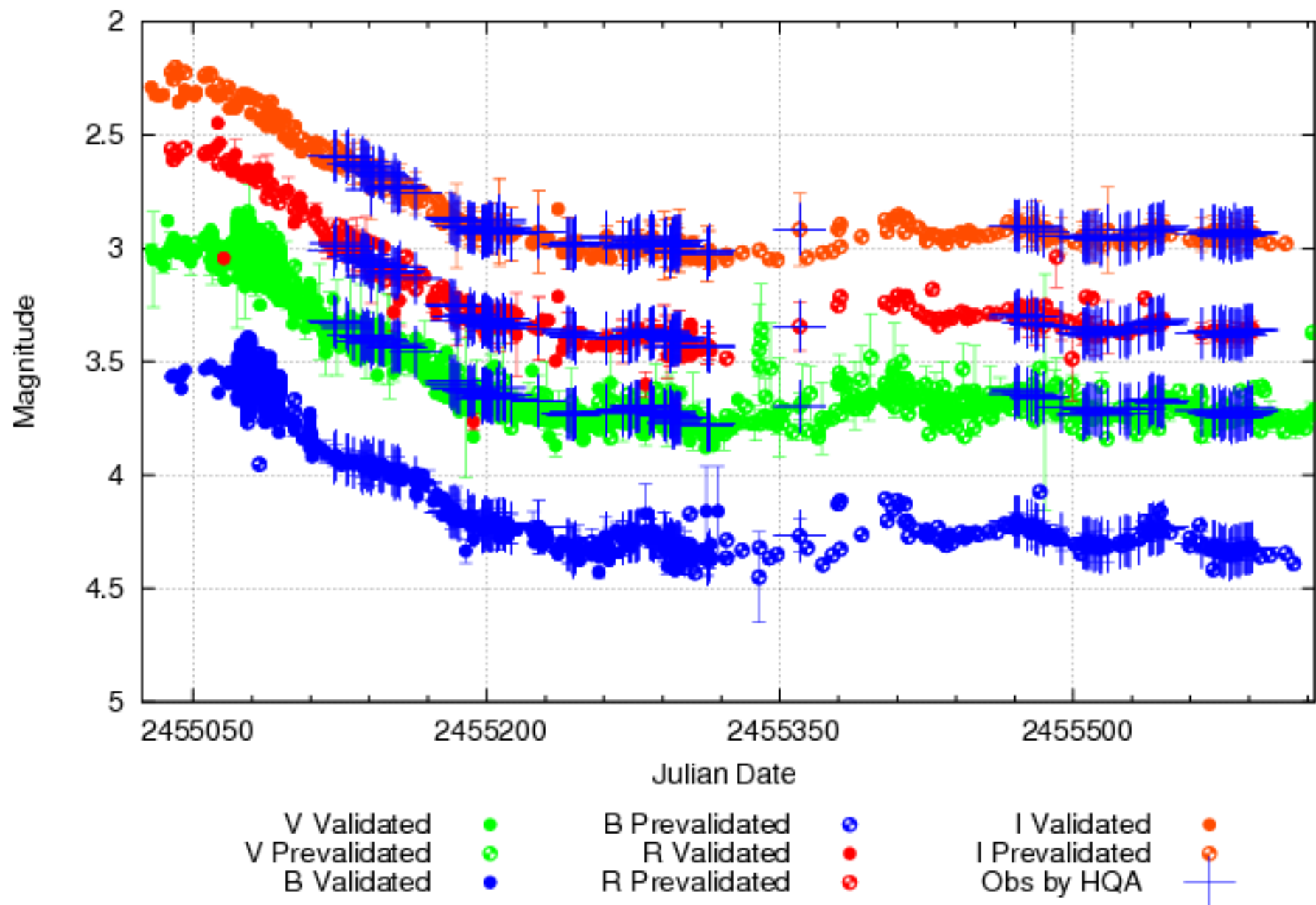
- 5 current systems
- 60-70mm aperture
- ST-8 camera, 2.2x1.4deg FOV
- $2 < V < 10$, BVRI
- Monitor bright variables in survey mode
- Some specific projects, time series
- \$7K/system (single donors)
- Want to extend to other longitudes



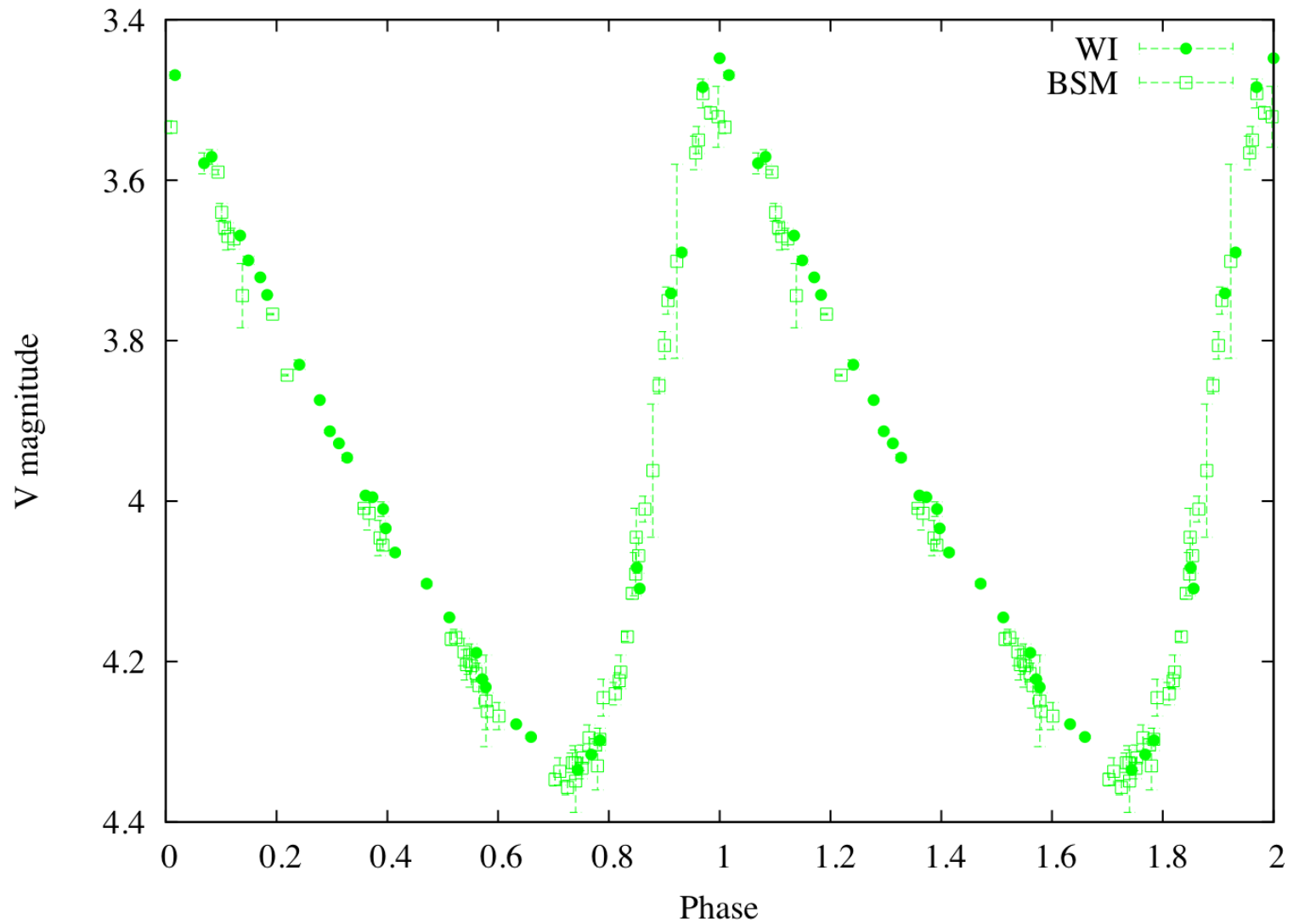
BSM M45 (Alson Wong, processing)



AAVSO DATA FOR EPS AUR - WWW.AAVSO.ORG



BSM del Cep PEP comparison

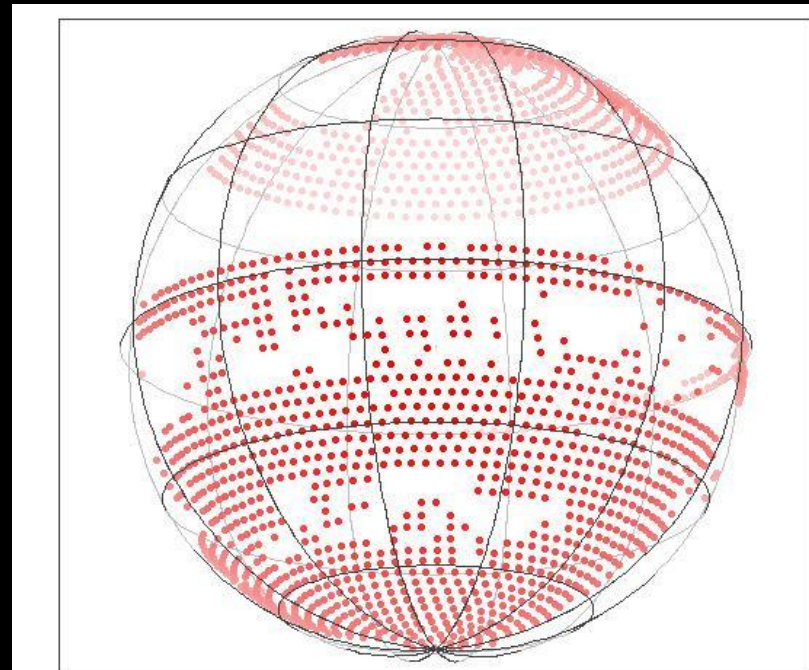
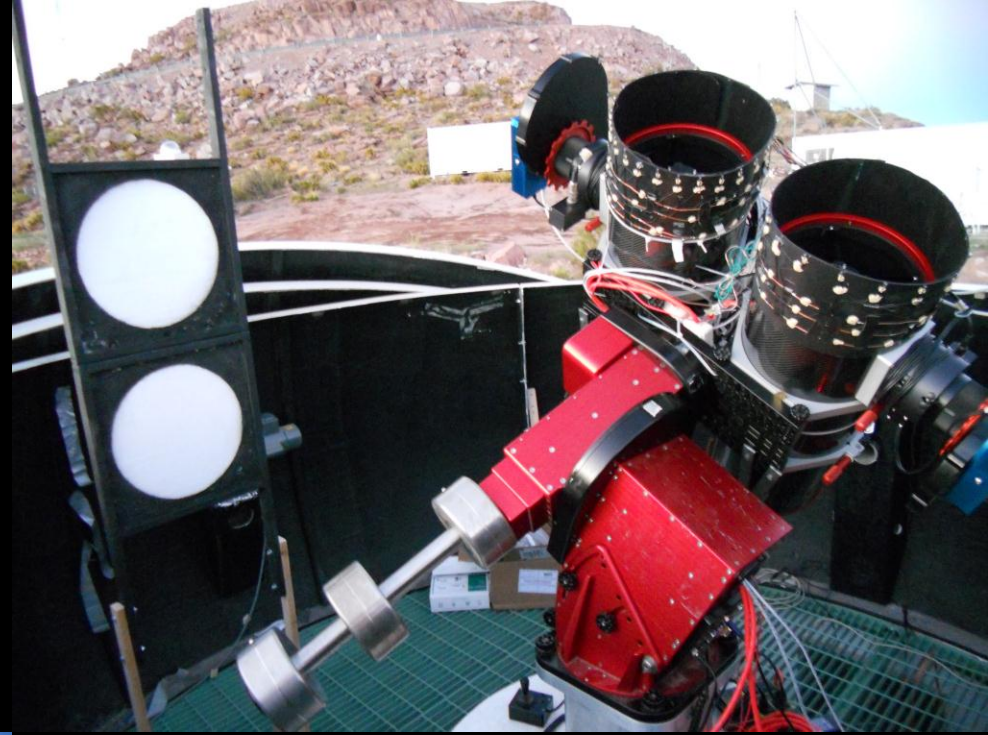


APASS

- AAVSO Photometric All-Sky Survey
- B,V,g',r',i'; 3-degree field of view
- $10 < V < 17$, 0.02mag accuracy
- Funded by R. M. Ayers Sciences Fund
- Located in NM and Chile
- 1/2 sky currently covered (see web site)
- Full moon, non photometric time available

APASS north/south

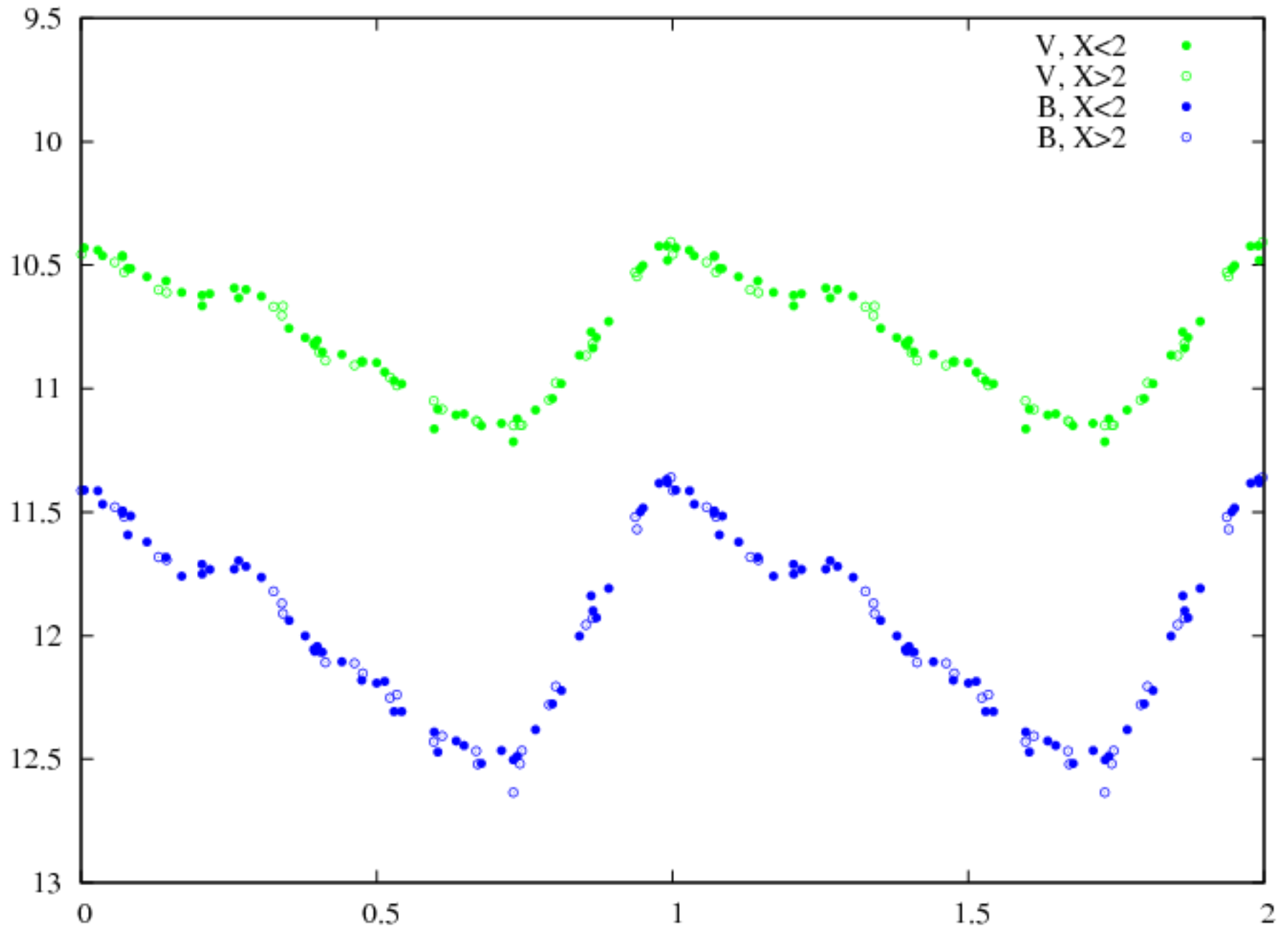
<http://www.aavso.org/apass>





h/chi Per

TZ Mon, all-sky



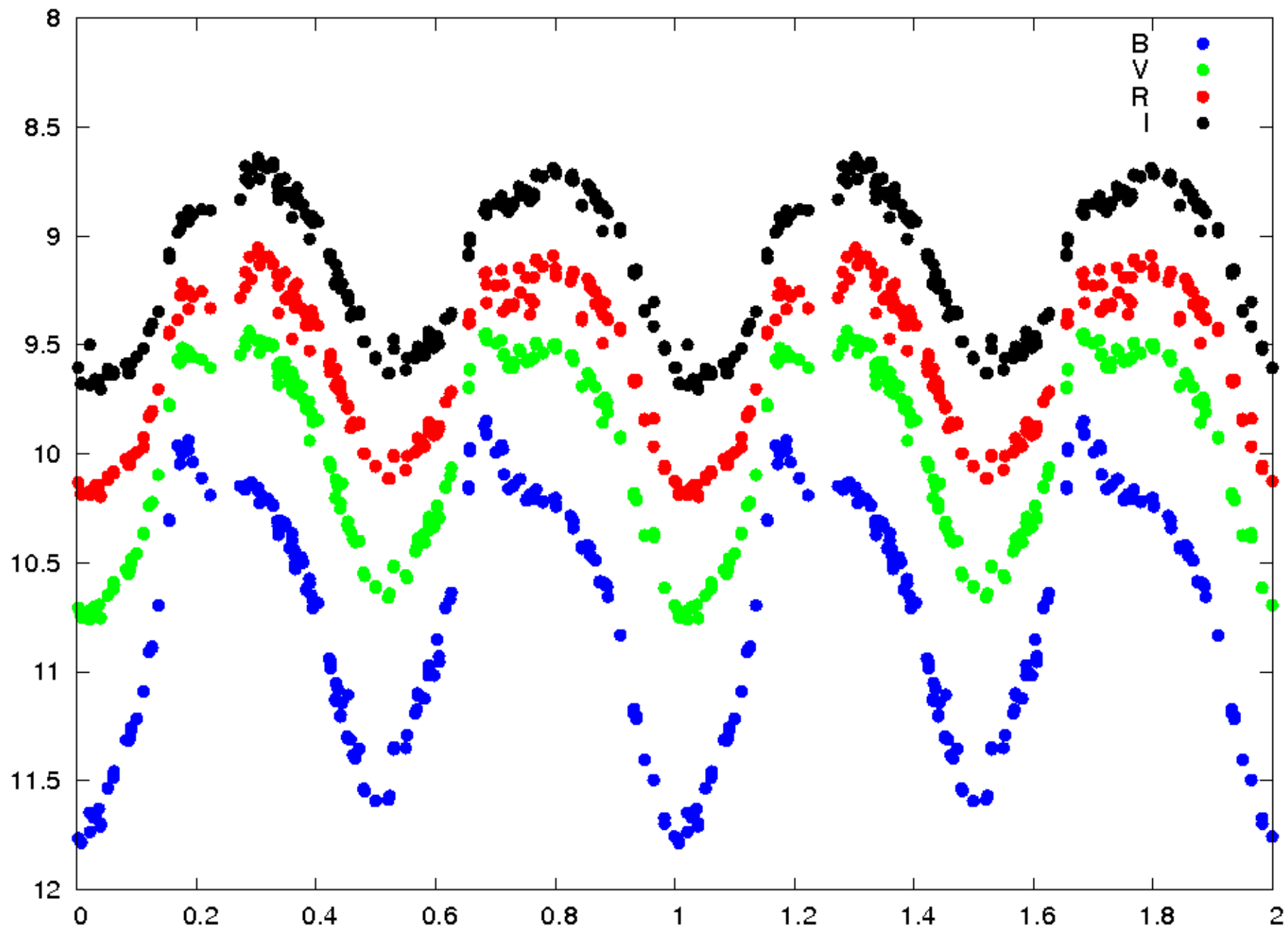
Mid-size (28-35cm)

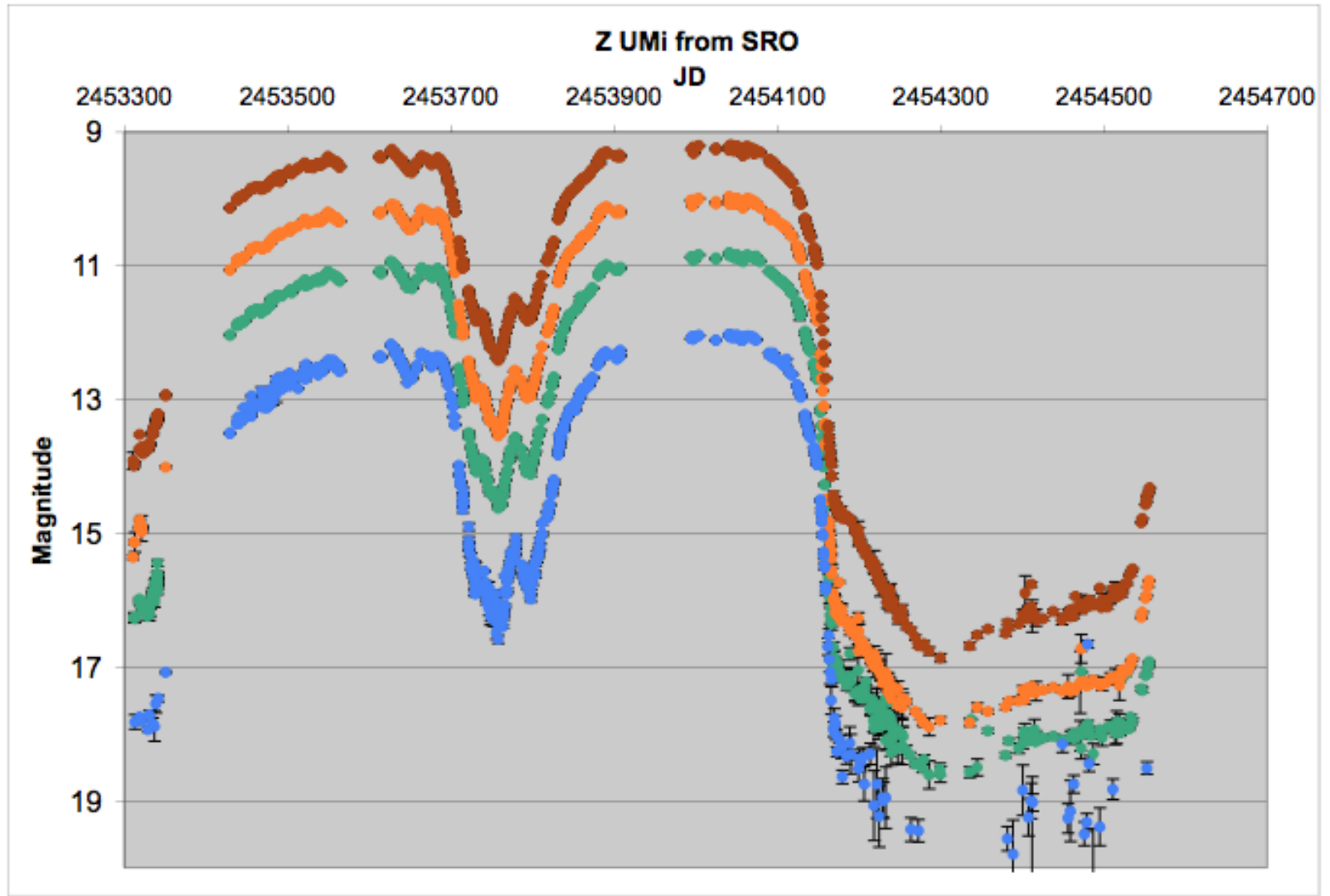
- 7 telescopes
- Some AAVSO, some private/loan/share
- Specific configurations (Sloan, narrow-band, diffraction grating, etc.)
- Primarily queued monitoring; some telescopes used for time series

Bareket 35cm (Israel)



W Vir, SRO 35cm





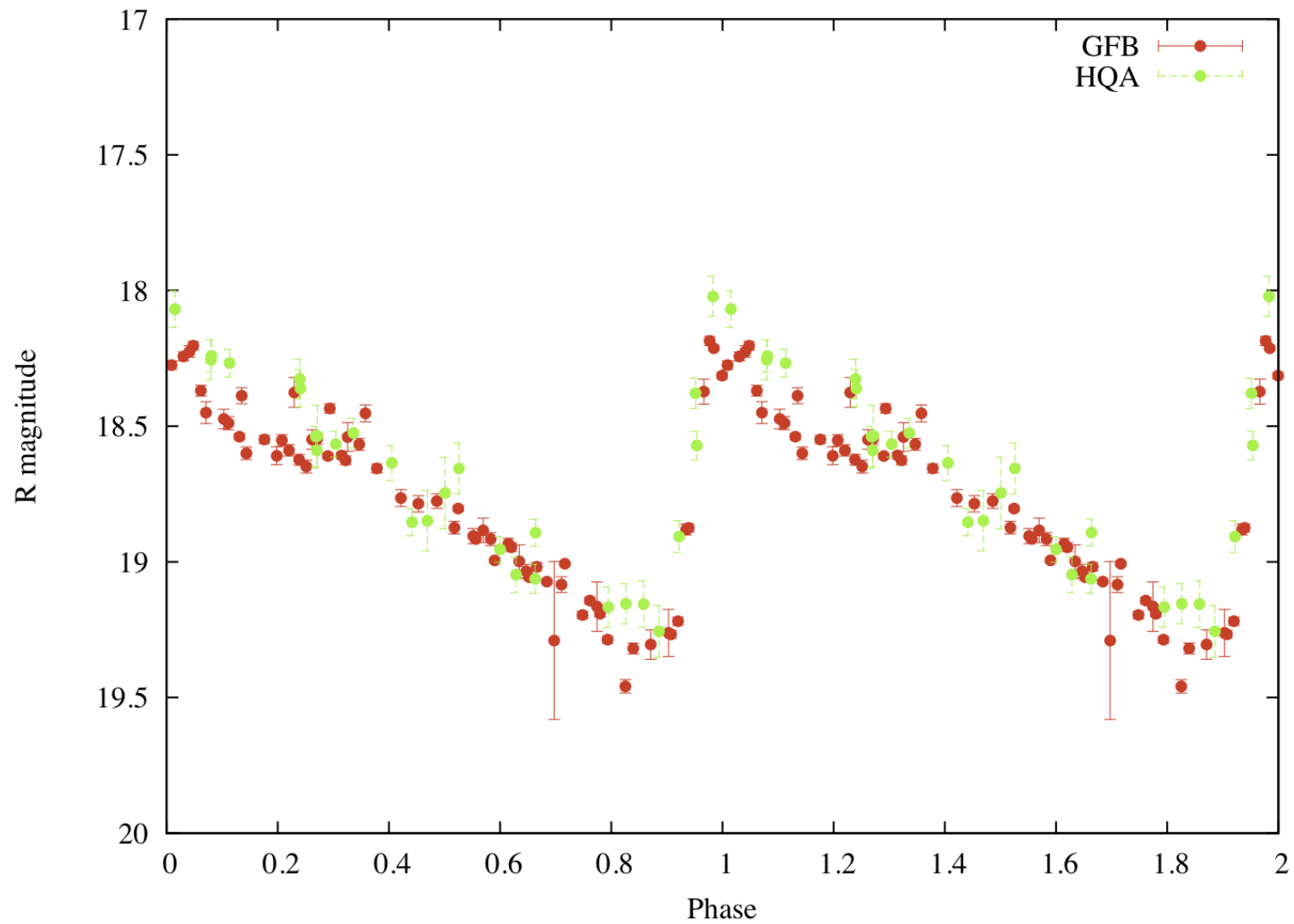
Large size (50cm+)

- 5 telescopes
- Most owned by others, refurbished by the AAVSO
- High-end instrumentation (echelle spectrographs, high-speed imaging; NIR planned)
- Reserved for optimized projects

Sonoita 50cm



Sonoita 35cm, GFB 50cm



Integrated Solution

- All images are dark subtracted and flat-fielded before access by users
- User can analyze using whatever software he/she wants, or...
- VPHOT photometry software, on Amazon Cloud, images automatically transferred. Outputs photometry in standardized format for submission to AAVSO
- VSTAR analysis software, does plotting, period determination
- In some cases (APASS), only pipeline processed photometry available, no images

Telescope Advocates

- Each telescope assigned staff/volunteer
- Makes sure data processed each night
- Ensures calibration frames taken regularly
- Interacts with users (mentor, questions)
- Checks data quality

Challenges

- Private sites; longevity
- Internet access
- Data archive/access
- Aging maintenance
- Volunteer aspect
- TAC/time allocation
- Non-imaging instruments

Summary

- Robotic systems need not be expensive
- Commercial software is available to automate entire process
- We're looking for a few more good sites
- AAVSONet access is free!
- <http://www.aavso.org/aavsonet>