Pi of the Sky full system and the new telescope

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On behalf of the Pi of the Sky Collaboration

http://grb.fuw.edu.pl/pi
There are many good reasons to build small, robotic telescopes...

- Low design, construction and operational costs.
- Autonomy of operation – long time baseline.
- Search for rare, unexpected events (afterglows of rare, cosmological phenomena)
- Flares, novae,...
- Monitoring of variable stars
- SSA
Pi of the Sky

• Inspiration by B. Paczyński, influenced by ASAS (G. Pojmański).
• University of Warsaw, National Center for Nuclear Research, Center for Theoretical Physics PAS, Warsaw Technical University, Space Research Center PAS, Creotech Technologies S.A.
Chile: 2004-2009

Pi of the Sky detector in Chile, 2004 - 2009

- ASAS dome, Las Campanas Observatory - Carnegie Institution of Washington
- 2 cameras (coincidence)
- Time resolutions: 10 s, 2 s readout time
- Range: 11.5 - 12.5 mag
- IR-cut + R Johnson-Bessel filter (since May 2009)
Custom designed cameras

- 2048 x 2048 pixels each
- Canon lenses, f=85 mm, f/d=1.2
- FoV of one camera $20^\circ \times 20^\circ$
- Fast, programmable electronics (FPGA, μP, RAM)
- Ethernet and USB2.0 interface
- Readout noise $\approx 15 - 20 e^-$
- 2 stage Peltier cooling of CCD
- Shutter designed for $10^7$ cycles
- Humidity and temperature measurement inside and outside chamber
Custom designed mounts

- Prototype in Chile - Pojmański design (ASAS) mount
- Spain: new design with 4 cameras (J. Grygorczuk, Space Research Center)
- Classical two-axis equatorial mount concept
- Mechanism for deflecting the cameras
- Controlled by the Controller Area Network
- Construction: Space Research Center, Institute of Experimental Physics, University of Warsaw
Status of Pi of the Sky telescopes

Moving prototype to San Pedro de Atacama Observatory, Chile, March, 2011

The SPdA panorama

The open dome and cameras at sunrise
New site in Spain

INTA El Arenosillo, Huelva, October 2010
Pi of the Sky database

Open access to all raw data:
http://grb.fuw.edu.pl/pi/databases

Data period May 2006 - April 2009
16.7 million of objects,
2.16 billion measurements

Data period May 2006 - Nov 2007
10.8 mln of objects,
1002 mln measurements

Data period July 2004 - June 2005
4.5 mln of objects,
790 mln measurements
Photometry accuracy significantly improves after removing bad quality data

For stars $7^m - 10^m$

$\langle \sigma_m \rangle \approx 0.015$ achieved
BG Ind light curve

Uncorrected light curve for BG Ind variable

- Quality improves significantly
- Uncertainty of the order of $0.013^m$ can be obtained

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Absolute properties of BG Ind - a bright F3 system just leaving the Main Sequence
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Team
Electronics cabinet
4 detectors at dawn...