

# Potential of astrophysical analyses with Ondrejov all-sky negative archive

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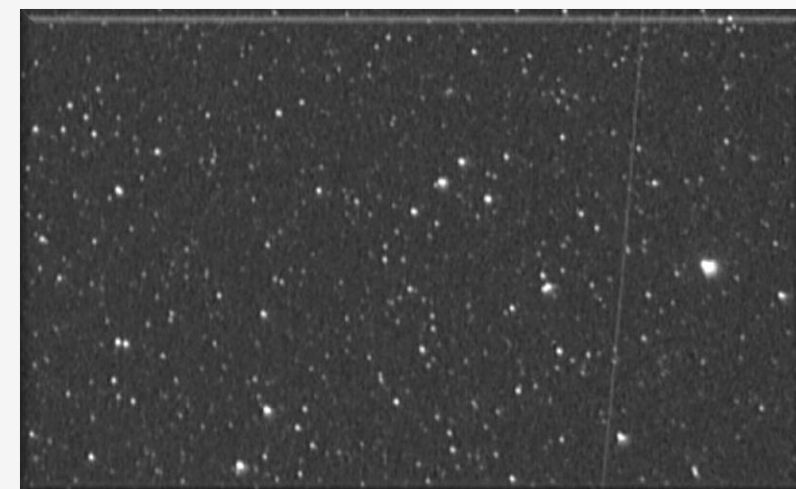
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GRB model

There are about 150 000 wide-field sky photographs, mostly all-sky, at the Ondrejov Observatory, taken within the bolide program originated by Zdenek Ceplecha. Apart from meteor studies, the negatives offer additional astrophysical applications.

Typical limiting mag on pointed exposures: 9 - 11  
Typical exposure time: 3 hours



Types of objects suitable for study on the Ondrejov all-sky photographic plates:

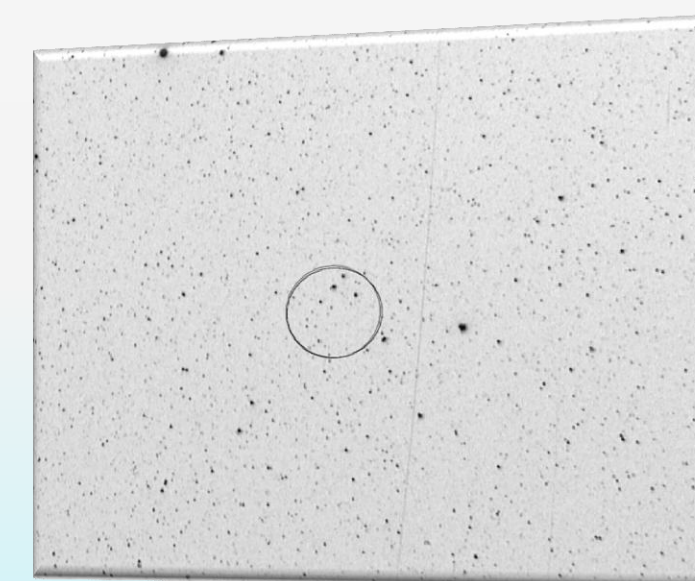
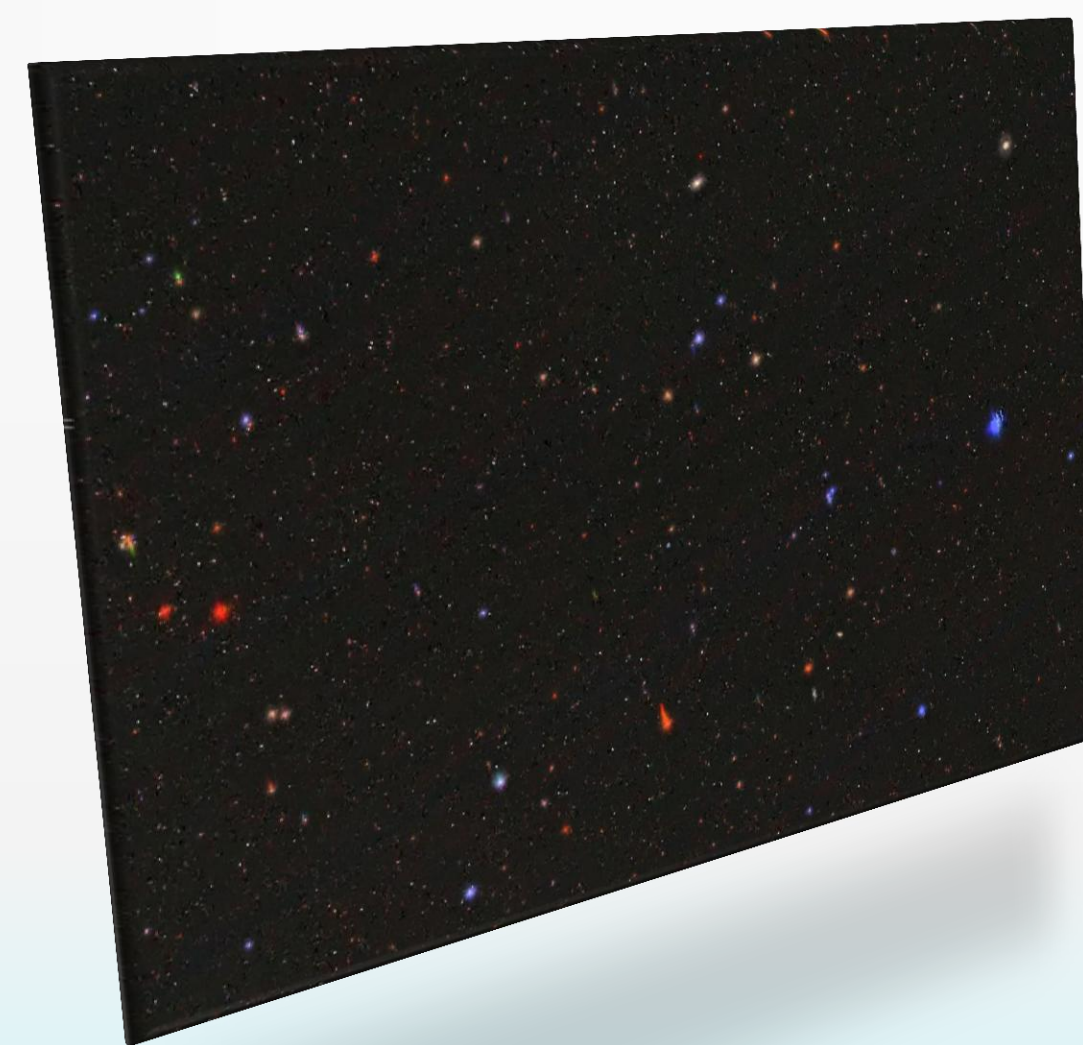
**Explosions of classical novae** - very strong brightening caused by episodic thermonuclear explosions of the accreted matter on the white dwarf in cataclysmic variables and some symbiotic systems  
Typical duration of explosion: weeks - months  
Typical amplitude: 12 - 15 mag  
The rise of brightness is usually very fast (a few days) - the event is often a new object in an "empty" position.  
- follow-up observations by the large telescopes can detect the cataclysmic variable or a symbiotic system in the position of the nova

**Optical afterglows (OAs) of gamma-ray bursts (GRBs):** very strong brightenings (more than 15 mag)  
- short duration (~minutes) of OA in the brightness levels accessible to Ondrejov plates - OA can be in only a single plate as a new object  
- follow-up observations by the large telescopes can detect the host galaxy of the OA

**Flares in active galactic nuclei (AGNs)** (e.g. Hudec, R., Vrba, F. J., Luginbuhl, C. B., Hartmann, D. H., 1996, ASPC, 110, 129)  
- duration of the flare: tens minutes  
- amplitude: 10 - 15 mag  
- follow-up observations by the large telescopes can detect the AGN

**Long-term activity in bright symbiotic systems** (e.g. AG Dra)  
- fluctuations and sometimes episodic brightenings  
- typical amplitudes: 1 - 2 mag  
- typical duration of the event: weeks

**Peculiar outbursts** like V838 Mon: probably mergers of two stars (Tylenda, R., Soker, N., 2006, A&A, 451, 223)  
- brightening by several magnitudes  
- duration of the event: more than a month



Gamma-ray bursts (GRBs) are powerful flashes of high-energy gamma rays lasting from less than a second to several minutes

In rare cases, they can reach naked-eye visibility (brighter than mag 6)

**GRB optical counterparts can be investigated on all-sky photographs taken at or near GRB times**

Fish eye field of view is 180°, limiting magnitudes 9-11 in V

Typical exposure time: 3 hrs for guided cameras, the whole night for fixed cameras

## **Methodics:**

Take a sky image with all-sky camera

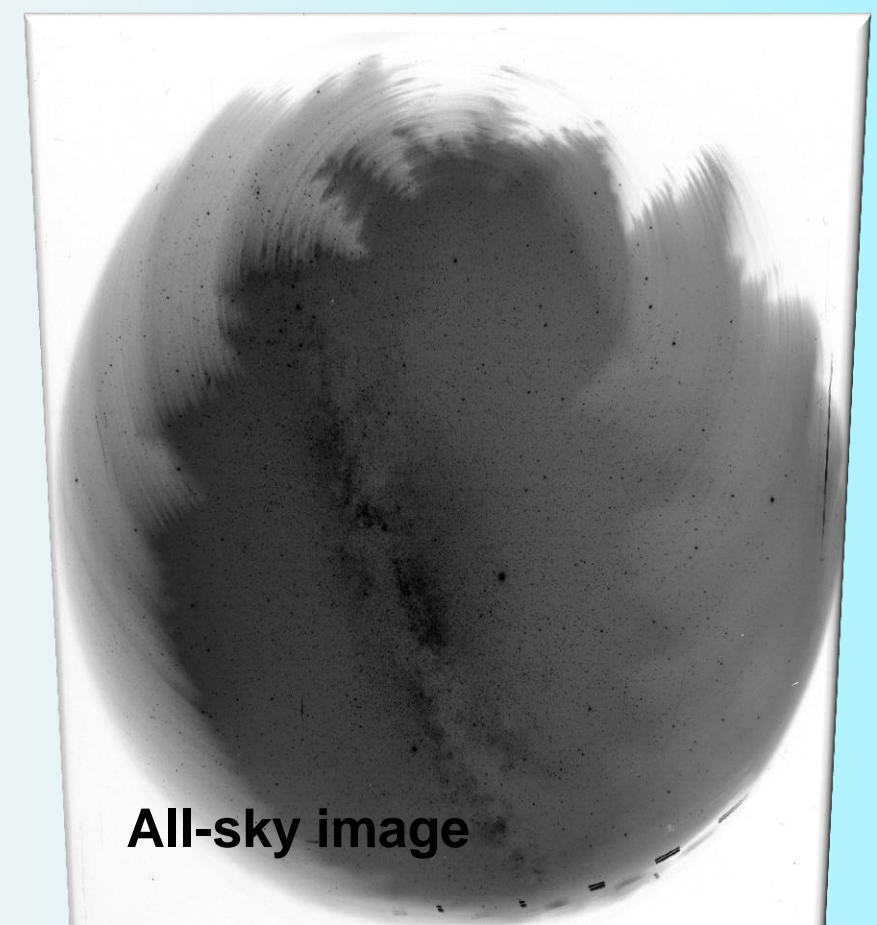
Cut a piece of photo with GRB position

Invert the colours

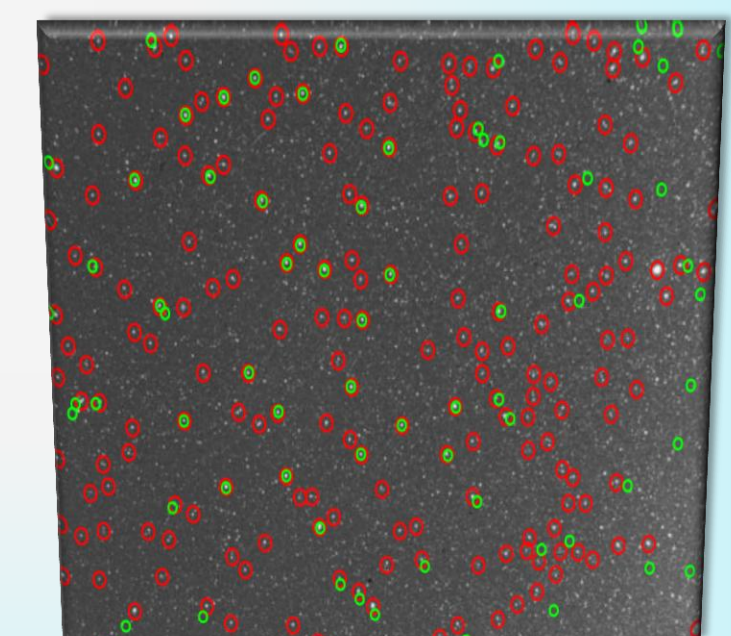
The stars must be white for use <http://nova.astrometry.net/>

Search for new object at the GRB position

Verification of objects with ImageJ



All-sky image



Red circles are stars that program found. Green circles are stars, where they should be. All sky photo with fish-eye lens introduced shifts.

## **The Conclusion:**

The use of Ondrejov all sky photo archive for astrophysics was investigated within the AS CR project Open Science III.