

## A NEW AUTOMATIC TOOL FOR PHOTOMETRIC TIME-DOMAIN ASTRONOMY

P. J. Mikołajczyk <sup>1,2</sup>, P. Zieliński <sup>3</sup>, M. Jabłońska <sup>1</sup>, M. Kałużyski <sup>4</sup>, K. A. Rybicki <sup>1</sup>, M. Ratajczak <sup>1</sup>, P. Trzcionkowski <sup>1</sup>, Ł. Wyrzykowski <sup>1</sup>

1. Astronomical Observatory of the University of Warsaw, Warsaw, Poland
2. Astronomical Institute of the University of Wrocław, Wrocław, Poland
3. Institute of Astronomy, Nicolaus Copernicus University in Toruń, Poland
4. Nicolaus Copernicus Astronomical Centre, Warsaw, Poland

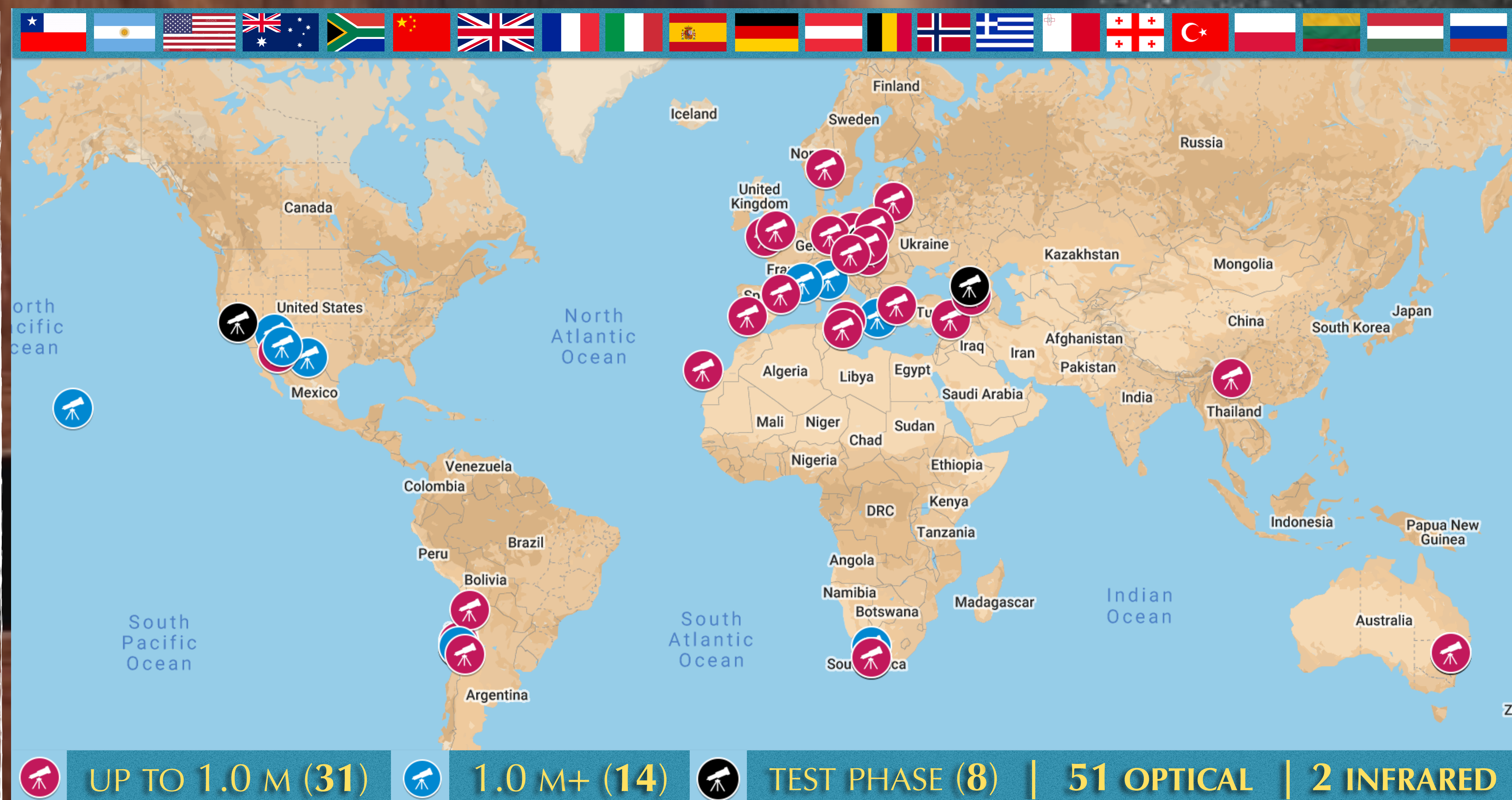


e-mail: [mikolajczyk@astrouw.edu.pl](mailto:mikolajczyk@astrouw.edu.pl)

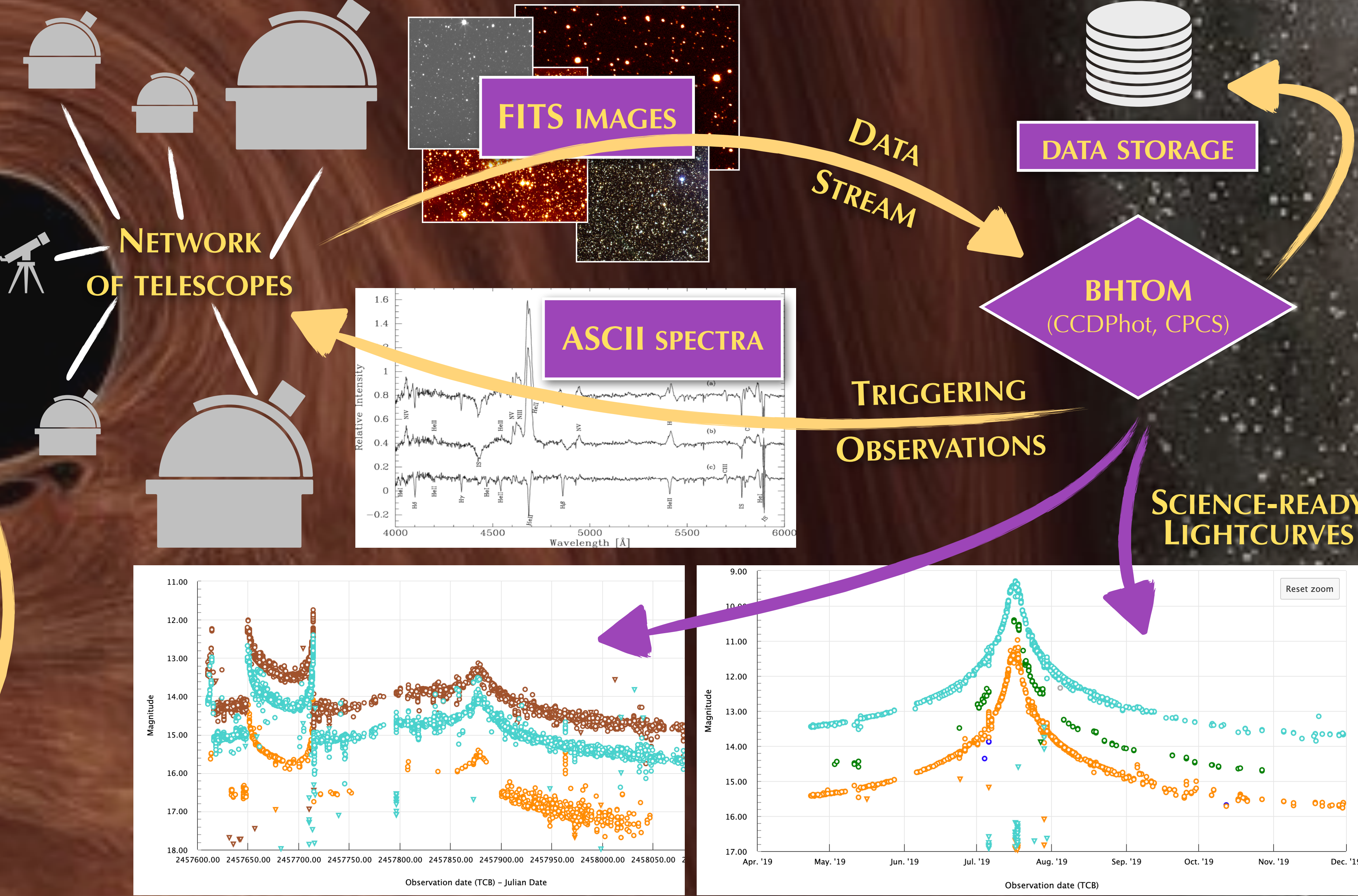
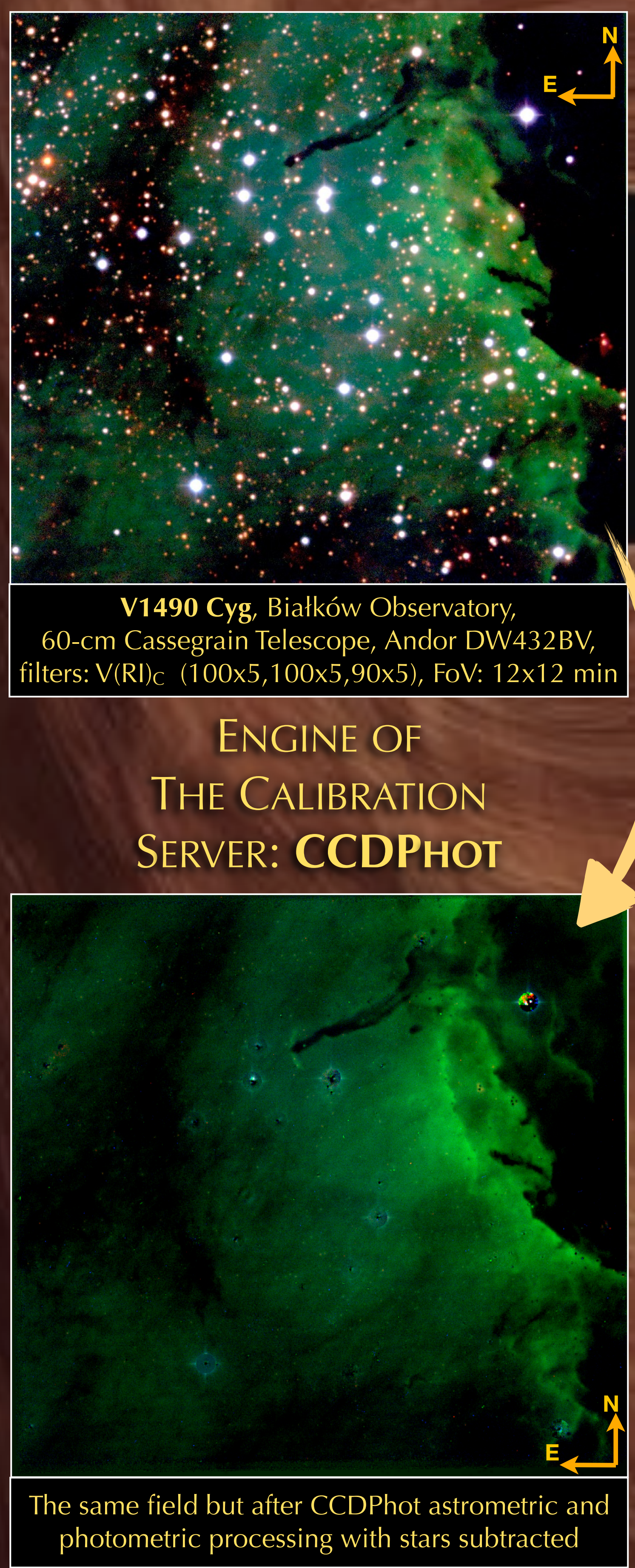
**ABSTRACT:** In the era of large sky photometric surveys, rapid and reliable processing of CCD images plays a crucial role in characterising transient phenomena. The Black Hole Target Observation Manager (BHTOM) is a new tool based on Las Cumbres Observatory's TOM, developed under OPTICON RadioNet Pilot (ORP) H2020 programme for managing the observations of time-domain targets based on alerts from surveys like Gaia, ZTF, or ASAS-SN. One of the most important features of BHTOM is an automatic calibration of photometric FITS images in order to obtain science-ready data points on light curves of observed targets. The system can be used to combine multi-wavelength photometric data from multiple telescopes and instruments within minutes from observations. Therefore, the tool can be widely used for a variety of time-domain applications.

### ORP TELESCOPE NETWORK

Within the **OPTICON RadioNet Pilot Time-Domain Astronomy** we have been coordinating the operation of multiple small- and medium-sized telescopes scattered around Europe and beyond. Many of these telescopes were built in the previous century and now have almost become obsolete due to the poor weather conditions in Europe, compared to the best sites like Chile, Hawaii, or South Africa. However, such telescopes when gathered into a network can still provide very useful scientific data, as well as serve as great training facilities for the next generation of astronomers. Involvement in a coordinated network is also an opportunity for developing countries to take part in world-class research. We have been cooperating with a network of approximately 100 (50+ already in BHTOM) telescopes from all around the globe with some of them collecting thousands of observations. New facilities are still being added to the BHTOM network of telescopes. The righthand figure shows the geographical distribution of our partners.



<b>D</b>	FITS image, information about observatory and instrumentation
<b>1.</b>	Standardization of FITS headers
<b>2.</b>	Creation of astrometric catalogues of reference stars
<b>3.</b>	Initial astrometric matching with Gaia-EDR3 and others
<b>4.</b>	Astrophotometry with SExtractor and SCAMP
<b>5.</b>	Automatic selection of stars for PSF model
<b>6.</b>	PSF photometry with DAOPHOT
<b>7.</b>	Aperture NEDA photometry with DAOPHOT
<b>8.</b>	Final precision astrometry with Gaia-EDR3
<b>R</b>	Delivering ASCII file with photometry + astrometry of all stars on the image, and FITS file with WCS (ICRS)
<b>S</b>	



### STATUS OF BHTOM DEVELOPMENT

Currently, the observers can use full the capabilities of the BHTOM portal (<https://bh-tom.astrolabs.pl>). They can use predefined observatories already tested within the system as well as add their own instruments to process FITS images and thus make their contribution to scientific publications. Proprietary photometric pipeline CCDPhot (Mikołajczyk et al., in prep.) provides precision astrometry based on up-to-date Gaia-EDR3 catalogue as well as profile instrumental photometry. Such measurements are subsequently being processed to standard photometry by the second version of CPCS Portal (<https://cpcs.astrolabs.pl>). It allows to combine data gathered by different setups and instruments to be standardized in order to provide a photometric light curves. Such a system allows less experienced observers, including amateurs and even school pupils to collect scientifically important observations without the need of tedious and difficult data processing.

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