



Data Processing

Igluka Genova, Felix Firmbach and Zeyu Zhu

Astronomy Seminar SS 2024

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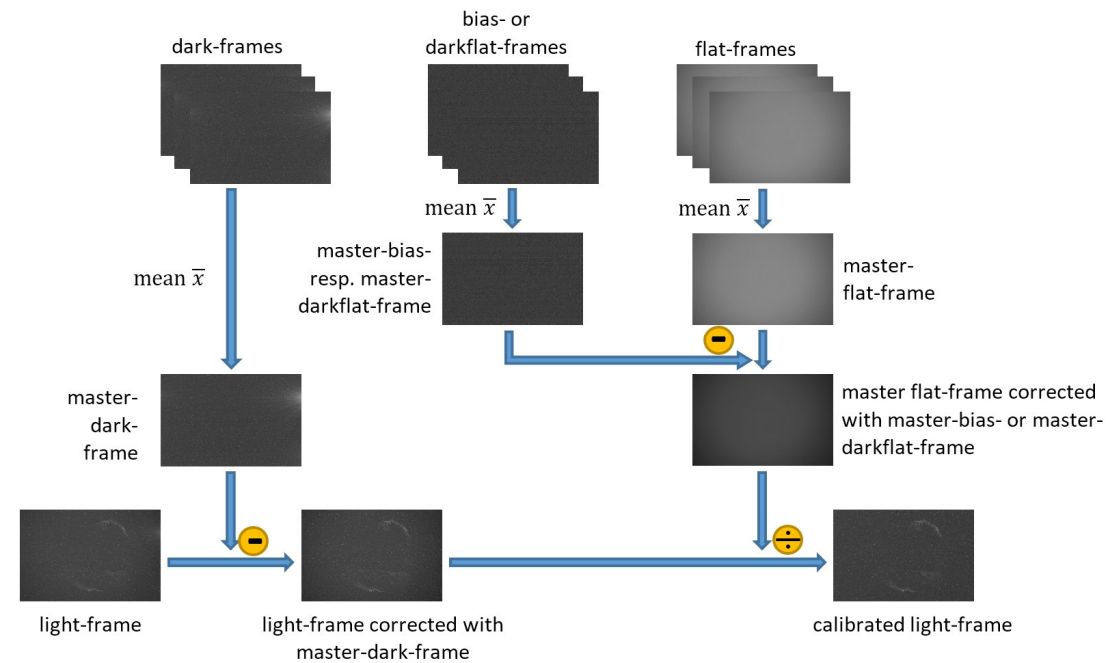
Image Calibration

Light Frames: Raw Images

Dark Frames: thermal noise correction

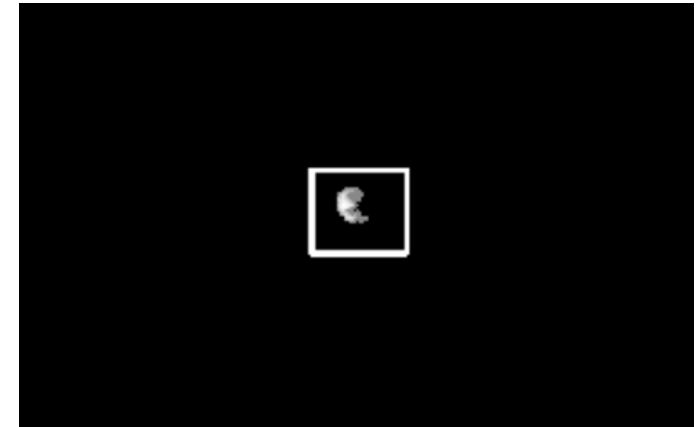
Bias Frames: readout noise correction

Flat Frames: vignetting and field illumination correction



Extraction of Rough Light Curves

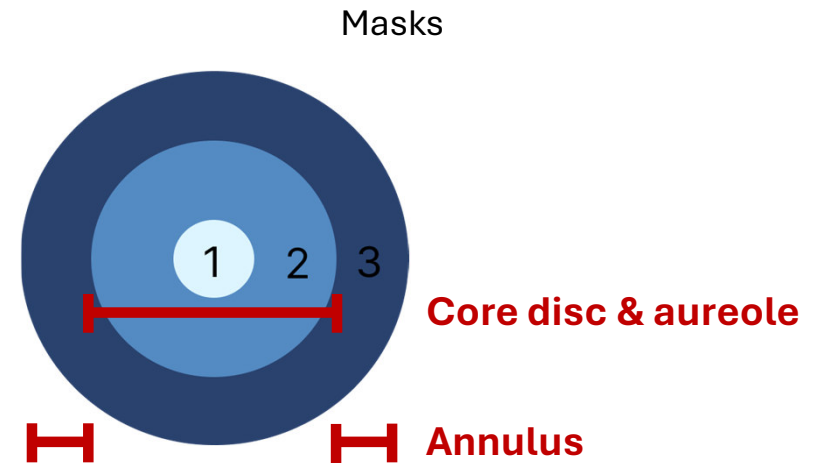
- Histogram Equalization for improved contrast
- OpenCV CSRT tracker
- Manually confirmed tracking
- Extract **centroids** from tracked box for mask application
- Interpolation for empty frames



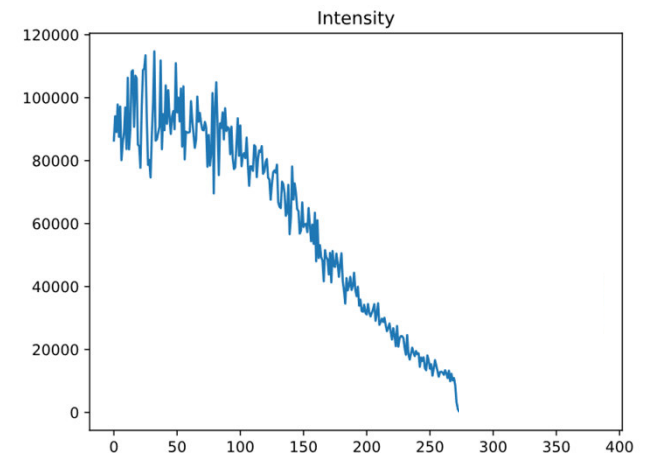
Single Frame(Tracking)

Masking and Data Conditioning

- Extract HWHM of reference point source
- Application of aperture mask [1, 2]
 - Based around tracked centroids
 - Width is 4x HWHM (ensures 99% of light is kept)
 - Restrict data to mask
- **Intensity** as sum of masked data
- Application of annulus mask [3]
 - Range 4-8x HWHM
 - “background” brightness
- Subtract annulus intensity from aperture intensity: **reduced intensity**

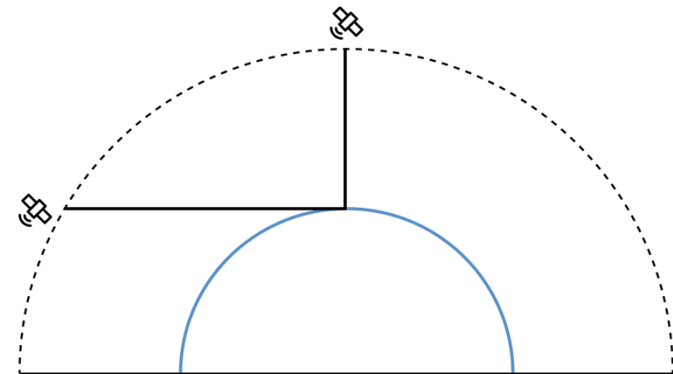


Raw Lightcurve for ARIANE 40 DB



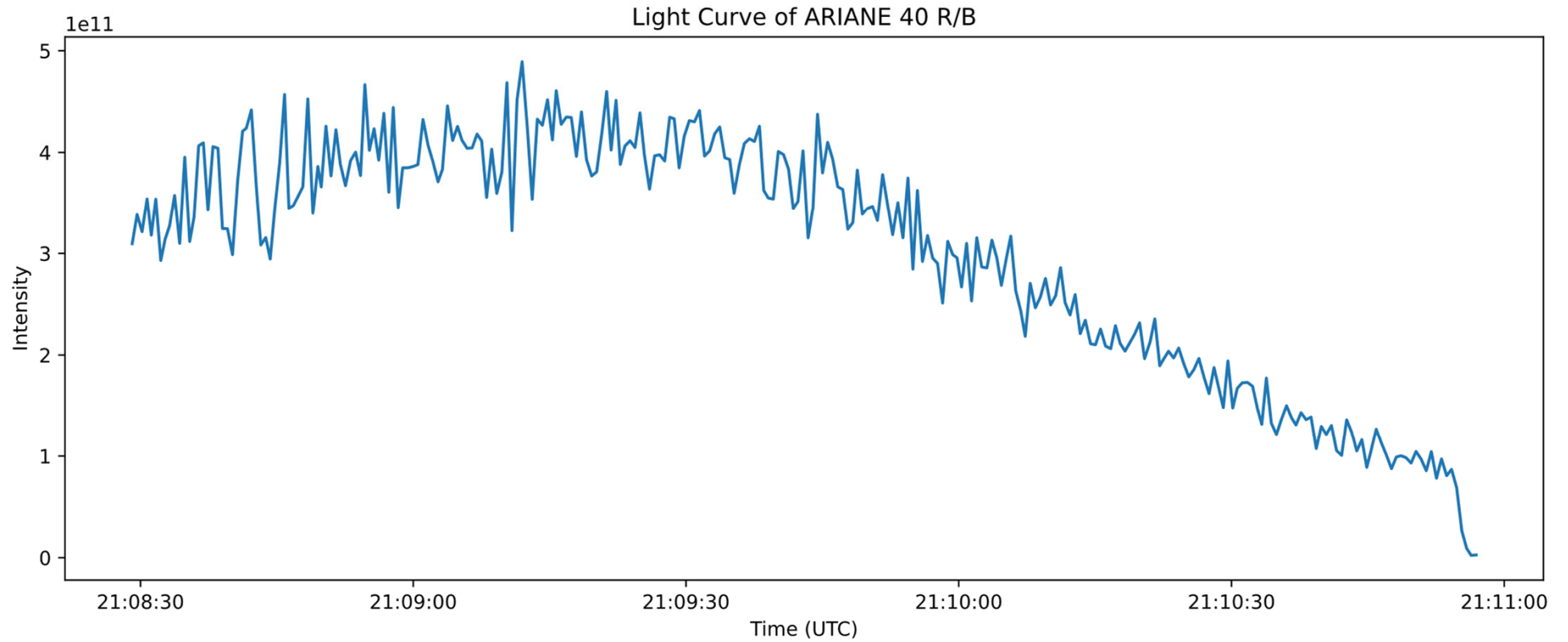
Range Correction

- During an overpass, the object changes its distance relative to the observer
- First, the raw light curves are imported
- The TLE of the satellite are extracted
- The topocentric position relative to Munich is calculated
- The altitude of the object is calculated
- The intensity values are corrected by using the inverse square law





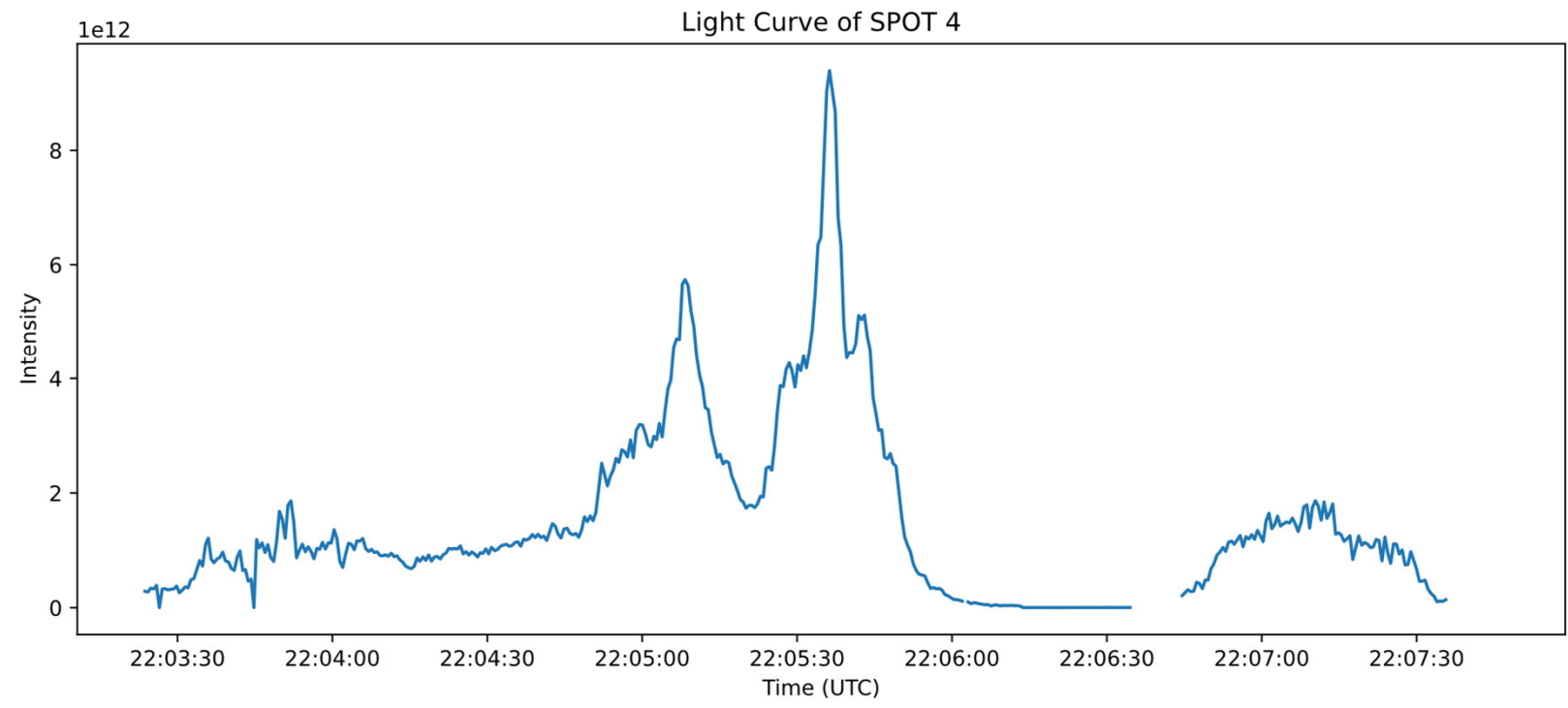
Results



25.06.2024

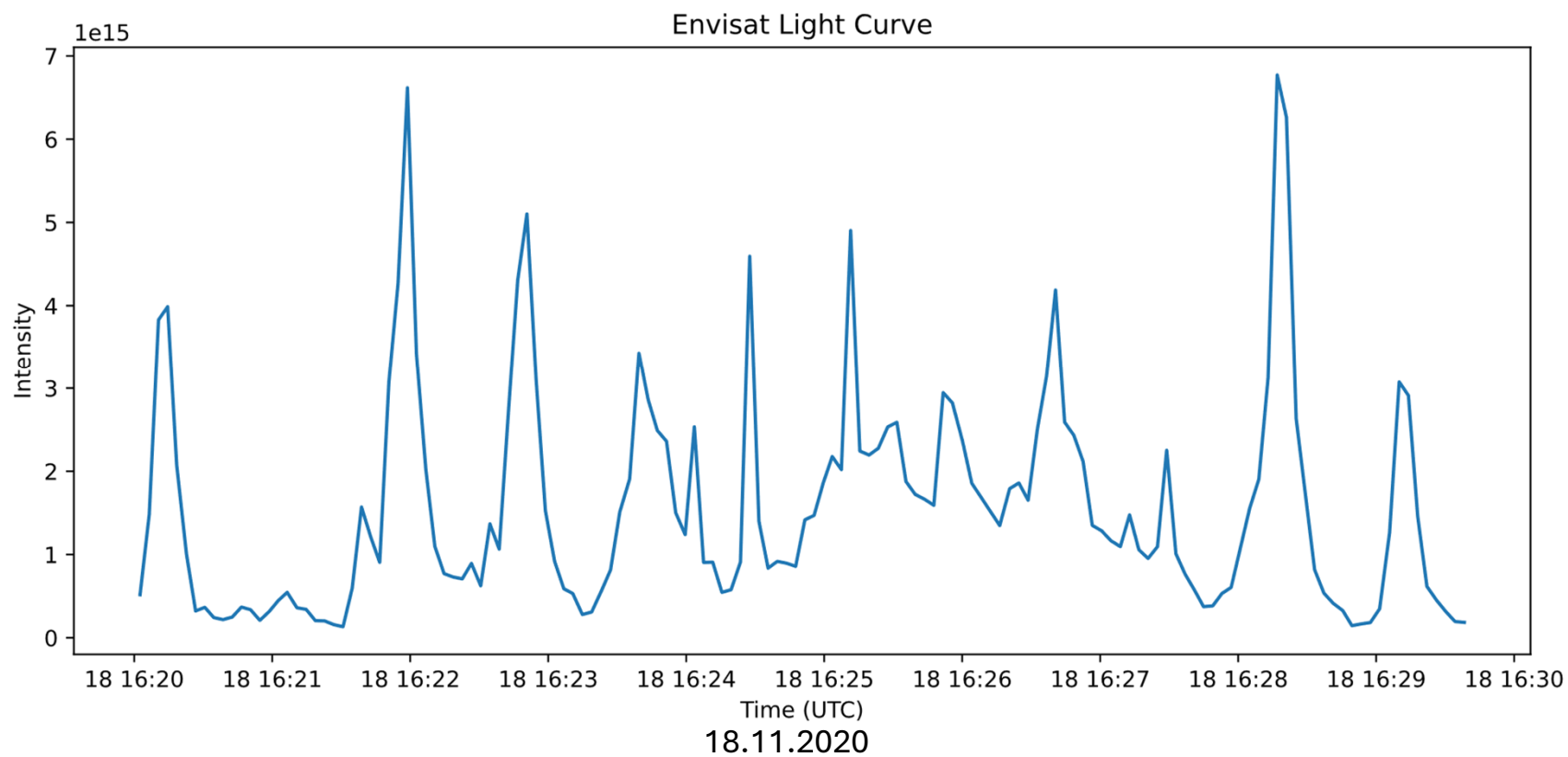


Results



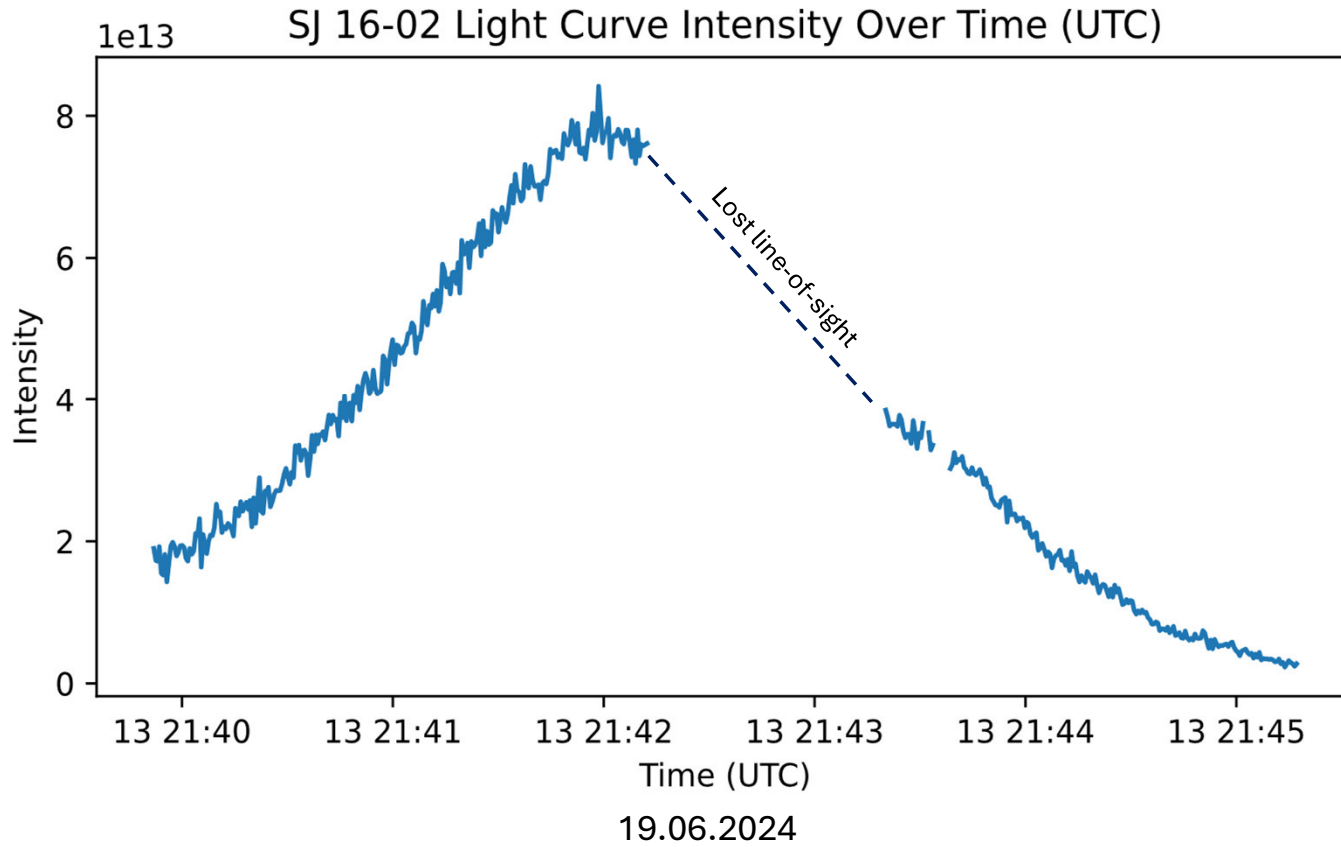
25.06.2024

Results





Results



Challenges Along the Way

- Tracking algorithm issues when object is at frame edge
- Frequent loss of object
- Arduous manual tracking process
- Tackling frames with low satellite visibility





**Thank you for
your attention!**

Questions?