NEMO

Near-UV **E**uropean **M**oon **O**bservatory

or

Never **Mo**ving Telescope

The Moon as a platform for unique astronomy

www.nemomoon.org

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Moon’s uniqueness

- **No atmosphere**
  - access to full EM spectrum
  - continuous observations, no day/night interruptions
  - photometric stability; no weather/seeing

- **Slow rotation**
  - only 1/28th of Earth
  - No need to follow the stars: ***static observatory***[1]

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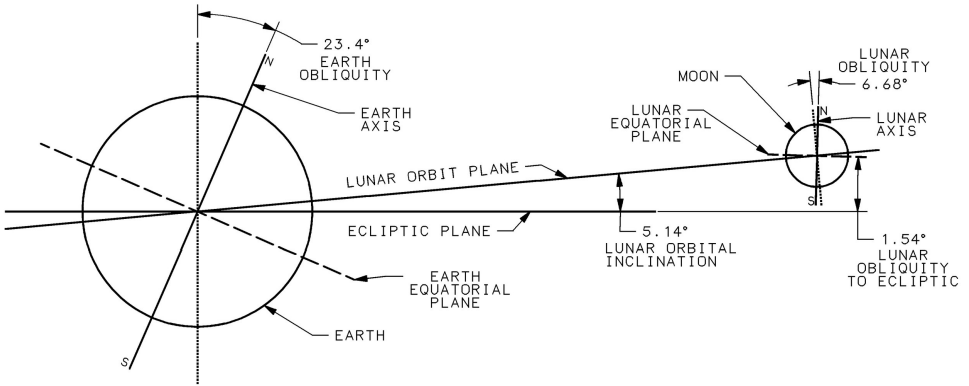
[1] Maximum drift speed at Lunar equator: v_o = 0.54 "/s

UV Transient Survey

Moon's features ideal for *UV Transit Transient Survey:*

- Sensitivity in near-UV range : 150-300nm
- Wide-field transit telescope : sky slowly drifts by (0.27 "/s)
- Selenic latitudes >30° : no Sun, no Earth in view
- Unparalled depth : mag_{AB} ~ 22.4 in 10s at SNR=5.

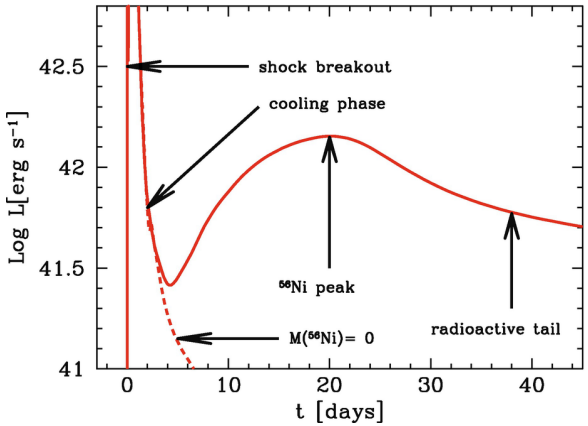


The Hot Universe

Science enabled by UV synoptic survey

- Shock break-out of supernovae
- Earliest phases of gravitational wave kilonovae
- Flares from exoplanet host stars and young stars
- Exoplanet and their host stars in the UV
- Hot star asteroseismology
- Compact binaries and stellar remnants: LISA sources
- Tidal disruption events from supermassive black holes

- The UV-Deep Universe through deep co-adds



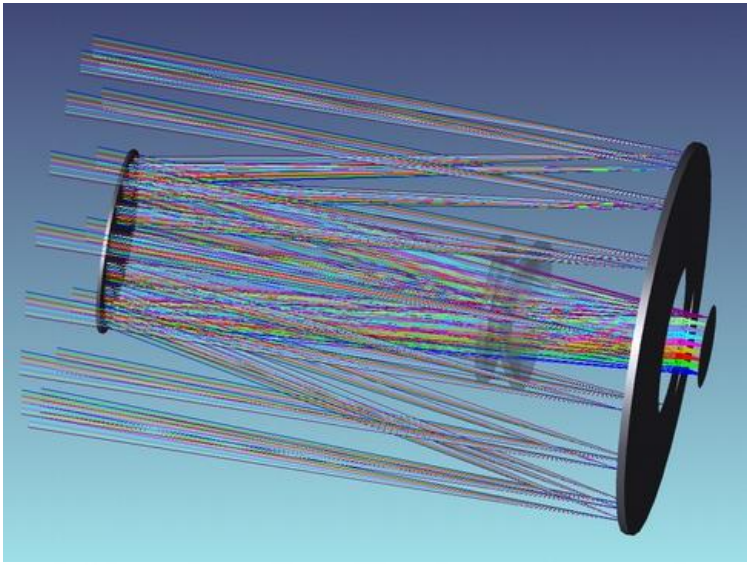
SN shock breakout

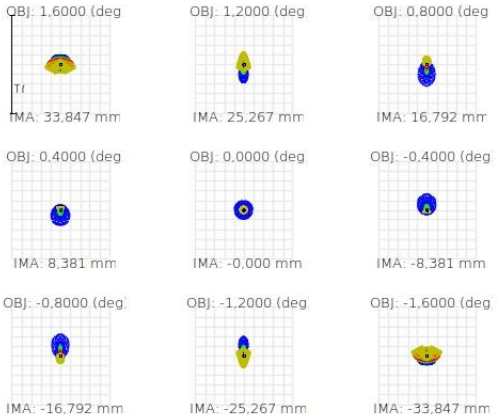
Strawman Design

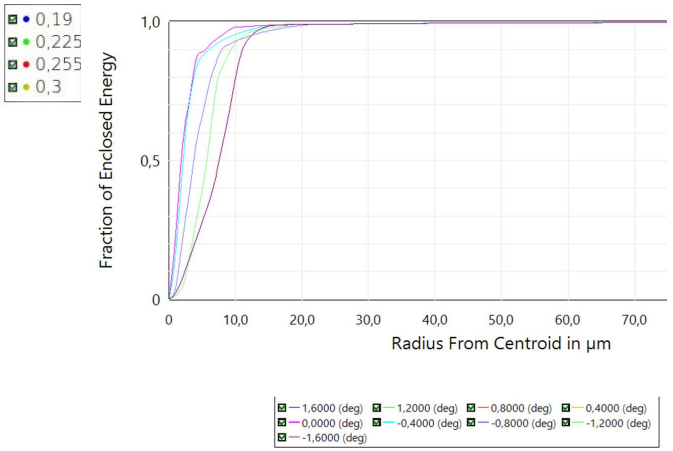
NUV telescope with

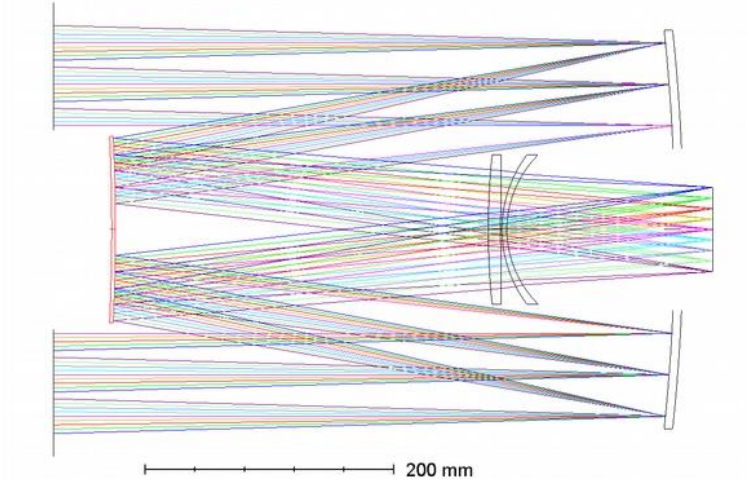
- Diameter : D = 30cm
- F-ratio : F/3.5
- Detector : CMOS 6k x 6k camera @ 10 μm pixels
  - → Pixel scale : 2 "/pixel
  - → Field-of-view : 3.3° x 3.3° ≃ 11 square degrees (11 ^{sqd})
  - → Sensitivity : m_{AB} = 22.4 @ SNR=5 @ t_{int} = 10s

Strawman Design









- Extremely compact design
- Excellent image quality up to 1.6d radius off-axis
- 90% enclosed energy within 15 microns
- Par-focal over full wavelength range

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Operations

- Preferred location : Lunar South Pole in near-continuous light
- Fixed pointing : $\delta_{\text{◗}} = 60° \rightarrow v_{\perp} = v_0 \cos(\delta_{\text{◗}}) = 0.27$ "/s
- Allow for 2-pixel drift : Cadence $t_{int} = 10$ seconds
- Source crossing time : 12.2 hrs
- No. exposure per source : 4400 per month
- Area surveyed : $3.3° \times 360° \times \cos(\delta_{\text{◗}}) \simeq 600$ square degrees

Configuration: Ring of 4 telescopes → 600 sqd/week, 17k exp/src/month

MASCARA-like ring configuration

Lander Requirements

- Compact configuration : 1.5 x 1.5 x 1.5 meter
- Total mass : ~250 kg → Low-mass (<50kg) t/b explored.
- Power : ~1 kW
- Communications : Direct or relay to Earth
  Minimal: fast alerts
  Maximal: packed reduced images
- Positioning : No special requirements
  : Once-off deployment (drop&go)
- Data Processing : On board
- Duration : 5yrs
- Location/Landing Site : mid-high latitudes, preferably South Pole