

# **Korea Astronomy and Space Science Institute**

## Call For Science Proposal for Korea Microlensing Telescope Network (KMTNet)



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# 1 Overview

The Korea Microlensing Telescope Network (KMTNet) is a wide-field photometric system operated by the Korea Astronomy and Space Science Institute (KASI). The system consists of three 1.6m wide-field optical telescopes equipped with mosaic CCD cameras of 18k by 18k pixels. Each telescope provides a 2.0 by 2.0 square degree field of view (FOV). Three telescopes and cameras were installed at the Cerro-Tololo Inter-American Observatory (CTIO) in Chile, the South African Astronomical Observatory (SAAO) in South Africa, and the Siding Spring Observatory (SSO) in Australia. This network of telescopes, spread over three different continents at a similar latitude of about -30 degrees, enables 24-hour continuous monitoring of targets observable in the Southern Hemisphere (Kim et al. 2016, JKAS, 49, 37).

The primary scientific goal of the KMTNet is to discover numerous extrasolar planets toward the Galactic bulge by using the gravitational microlensing technique. Therefore, the bugle observation time for primary science has already been allocated. Some others will be open to the Korean astronomical community.

This document describes the Call For Proposal for the third run of the KMTNet operation. This third run will start on Jan. 1, 2024, and will carry out for three years till Dec. 31, 2026.

The followings are a list of important milestones.

- Dec. 5, 2022: Release of the Call For Proposal
- Mar. 31, 2023: Deadline to submit Proposal
- Jun. 30, 2023: Review of the submitted Proposals
- Aug. 31, 2023: Selection of the Proposals and presentation at the KMTNet workshop
- Jan. 1, 2024: Start of the third run

## 2 Summary of the KMTNet System

The following table summarizes important information about the KMTNet system.

|                      |   |
|----------------------|---|
| Telescope            | <ul style="list-style-type: none"> <li>- Primary mirror of 1.6m in diameter</li> <li>- Fork-type equatorial mount</li> <li>- Prime-focus optics with four wide-field correcting lenses</li> <li>- Delivered Image Quality less than 1.0 arcsec FWHM within 1.2 degree radius FOV for I-band (under atmospheric seeing of 0.75 arcsec)</li> <li>- Optical performance optimized in I-band</li> <li>- Drawer-style filter changer to mount four filters simultaneously</li> <li>- Johnson-Cousins BVRI filters and LSST gri filters in all three sites</li> <li>- SDSS griz filters and H alpha filter in the KMTNet-CTIO site</li> <li>- Filter size of 310 mm x 310 mm and a thickness of 10 mm</li> <li>- Sliding shutter with rectangular blades, minimum exposure of 1 second</li> </ul> |
| Camera               | <ul style="list-style-type: none"> <li>- 18K by 18K CCD mosaicked with four 9K by 9K e2v chips</li> <li>- Pixel scale of 0.40 arcsec and wide FOV of 2 by 2 square degree</li> <li>- Quantum efficiency of ~85% in V-band and ~80% in I-band</li> <li>- 16-bit ADC and readout noise of about 10 electrons</li> <li>- The overhead time of about 60 seconds in total, including readout time of about 30 seconds with 32 readout channels (8 channels/CCD)</li> <li>- CCD chip cooled down to about -110 degree Celsius</li> </ul>  |
| Site and Observation | <ul style="list-style-type: none"> <li>- CTIO in Chile: time zone of +4 hour</li> <li>- SAAO in South Africa: time zone of -2 hour</li> <li>- SSO in Australia: time zone of -10 hour</li> <li>- Observations by resident observers at each site</li> </ul>   |
| Data Handling        | <ul style="list-style-type: none"> <li>- All raw CCD images are transferred to the KMTNet data center at KASI via network communication</li> <li>- The raw images are preprocessed by the KMTNet pipeline</li> <li>- Researchers can access the preprocessed images within two days</li> </ul>  |

### 3 Science Policy

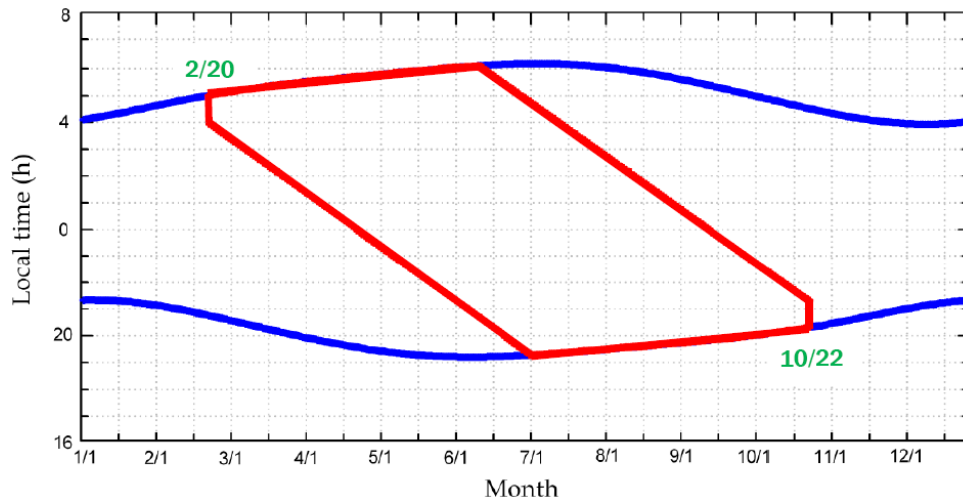
Researchers who plan to use the data obtained with KMTNet should observe the science policy described below. Note that **all proposal applicants are assumed to agree with this policy.**

#### 3.1 Observation Time Allocation

Observation time to monitor the Galactic bulge has already been assigned to the KMTNet primary science (called BLG). It corresponds to about 38% of the total operation time. About 12% will be allocated for system maintenance and the director's time. About 9% (300 hr/site/yr) will be awarded to each host site (called SITE), and another 9% will be used for the LSST in-kind contribution.

The other time of about 32% will be open to the Korean astronomical community and be assigned to the KMTNet secondary sciences (i.e., accepted proposals), mainly during the non-bulge season. It corresponds to about 1,060 hours per site per year.

The following graph shows the bulge observing time in red and the non-bulge one in blue at CTIO in Chile. This pattern is almost identical to the other two sites because of their similar latitudes.



#### 3.2 Target of Opportunity (ToO)

The ToO time will be operated for the immediate time-series observations of important transients such as Gravitational Waves (GW), Gamma-Ray Bursts, Supernovae, and Potentially Hazardous Asteroids. The KMTNet's policy for ToO is as follows.

- The ToO time will be restricted to less than 200 hr/site/yr. It will be supported in two ways, that is, 30 minutes each night (150 hours = 0.5 hours\*300 nights) plus the other 50 hours, which is similar to the time allocation for the LSST in-kind contribution.

- The time of 30 minutes will be available either just after the evening astronomical twilight or just before the morning astronomical twilight. It is useful for follow-up monitoring of transient events.
- The 50 hours for each site will be limited to the most important observations that require KMTNet's wide field of view and rapid accessibility within a few hours; for example, a wide-field survey for the first identification of the GW's optical counterpart. The ToO run has a higher priority than the pre-assigned observation programs, except for some irrecoverable programs such as BLG, SITE, and LSST in-kind contribution.
- The ToO proposals will be reviewed separately, and only the accepted ToO programs can use the ToO time. The ToO observation data will be open to all the accepted ToO programs without any proprietary period.

### 3.3 Evaluation

Several specialists will review the submitted proposals. Based on the review results, the KMTNet team will select science cases for the third run and assign observation time. Proposals with low ratings will not be accepted.

The accepted and executed observation programs should present their ongoing status and plan at the KMTNet workshop, usually held at KASI once every year. Poorly performing programs may be terminated before the nominal proposed end of the program based on decisions made by the KMTNet advisory committee.

### 3.4 Data Release to the Public

The regular proprietary period of the data obtained with the KMTNet is one year, after which all the data will be publicly available on the KMTNet website. This period may be extended up to three years with the approval of the KMTNet advisory committee.

### 3.5 Publication of the KMTNet Data

All the publications based on the KMTNet data should observe the guidelines for publications as below.

- All papers using the KMTNet data should include the word 'KMTNet' in the manuscript, preferably in the title or abstract.
- The papers should include at least one KASI staff member as a co-author. The KASI staff participating in the research team of the proposal will review the observance of the publication guidelines before the paper submission.
- At least one paper on the KMTNet project should be cited as a reference.
- The papers should include the following acknowledgment, "This research has made use of the KMTNet system operated by the Korea Astronomy and Space Science Institute (KASI), and the data were obtained at three host sites of CTIO in Chile, SAAO in South Africa, and SSO in Australia."

## 4 Content of the KMTNet Observation Proposal

The proposal boosting the scientific capability of KASI and producing synergy with the existing KASI research activities is favorable. The proposal to collaborate with researchers in host countries (i.e., Chile, South Africa, and Australia) is encouraged. The proposals for similar research topics may be advised to be unified during the review process. Therefore, discussions for collaborative research are recommended before the proposal submission. The proposal should be less than five pages and written in English.

### 4.1 Research Title

### 4.2 Organization of Research Team

- Name/Affiliation/E-mail of the Principal Investigator (PI) and all collaborators
- The proposal should include at least one researcher working at KASI.

### 4.3 Abstract

### 4.4 Observation Method

- Wide-field Survey/Monitoring or Target of Opportunity (ToO). The proposal for ToO should be submitted separately (see section 3.2).
- Observation Target(s) and Spectral Filter(s)
- Site(s): observation at all three sites or any specific site
- Requested Time: number of nights/hours, lunar phase, seeing condition, etc.

### 4.5 Scientific Justification

- The description should be less than two pages, including graphs and references.

### 4.6 Feasibility and Adequacy

- Describe the feasibility of using the KMTNet and justify any special requirements (e.g., site preference, specific time, and specific filter).

### 4.7 Recent Publications of the PI within Five Years

- List only the papers closely related to the proposal. If the PI is the previous user of KMTNet, list separately the papers that used the KMTNet data.
- A long list of publications can be attached as an appendix.

### 4.8 Expected Outputs

- Describe the expected outputs qualitatively (e.g., scientific impacts) and quantitatively (e.g., number of papers).

### 4.9 Remarks

- Justify the proprietary period's extension request (see section 3.4).
- Describe the other requirements, such as additional filters for better results.