

## Policy for Target of Opportunity (ToO) Observations at LDT

### HISTORY

Latest version: 2021-Sep-22 (sel) - minor updates, formatting changes

Prior version: 2015-Oct-20 (hr)

### 1. OVERVIEW

Target of Opportunity (ToO) observations provide scientifically valuable data on objects whose observability cannot be predicted. LDT's ability to switch quickly between instruments makes it an ideal facility for ToO programs that require rapid response, such as observations of newly discovered Solar System objects, gamma-ray bursts, supernovae, cataclysmic variables and other transient phenomena. Because the instrument cube allows instruments to be switched in about one minute, the LDT has the potential to become a leading facility for ToO observations.

In this spirit, the partners have agreed to implement the ToO policies and procedures outlined in this document, with the following goals:

- To maximize the scientific return of ToO programs while also minimizing the impact on regularly scheduled programs
- To limit the demands on observatory operations, staff and budget
- To respect and support each partner's right to control how it uses its share of telescope time
- To institute a streamlined protocol that will allow one partner's ToO programs to interrupt another partner's scheduled programs
- To ensure fair time accounting that reflects the 'clear weather' premium afforded to ToO programs and provides compensation to partners whose programs are interrupted
- To recognize other categories of observations that merit protection from ToO interruptions
- To establish expectations for publications resulting from ToO observations

The policies and procedures described herein shall be reviewed yearly at the annual partners' meeting and revised if and as needed.

### 2. THE TOO PROCESS

All observing programs that will involve ToO observations must specify them as such in the proposals, be reviewed by the proposer's home institution TAC like classical proposals and delivered to the LDT scheduler along with classical proposals. These requests shall include all instrumentation requirements. ToO proposals should also specify clearly:

- the criteria by which the decision to trigger will be made and an estimate of how frequently such criteria are likely to be met.
- the necessary response time-scale (e.g. immediate, within an hour, next night, within several nights)
- the amount of on-sky time that will be needed per activated ToO, including whether that amount of time is variable depending upon what the ToO finds in its first few observations.
- who will do the observing, and confirmation that they have the appropriate experience to observe remotely.

A ToO program can interrupt a scheduled observer for no more than two hours in a given night. In cases of exceptional scientific opportunity, the Director or their designate has the authority to override this time limit, allowing the ToO observations to continue beyond the two-hour window. Such requests should be made before the start of the scheduling period whenever possible, however real-time requests can also be considered.

No more than one ToO trigger is permitted per night. ToO observations are done on a first come, first served basis.

ToO observations must make use of instruments already installed on the LDT instrument cube and in their currently available configurations (i.e., no grating changes or swapping filters out are permitted during the night). In the case where the ToO is triggered more than a day ahead, filter and/or grating changes will be considered if they do not conflict with the otherwise scheduled program(s).

To maximize efficiency and provide rapid response, approved ToO programs can interrupt a scheduled program by phoning the LDT control room and informing the Telescope Operator; no further permission is required to trigger. Two types of ToO interrupts are possible.

- A rapid response trigger requires that the scheduled observer or observers turn the telescope over to the ToO observers within 10 minutes of the trigger.
- A regular ToO interrupt requires that the telescope be turned over within 30 minutes.
- If the ToO team triggering the interrupt is able to, as a courtesy, they are encouraged to notify the TO(s) and the observers who will be interrupted as far in advance as possible to allow the interrupted group to plan their observations to take account of the interrupt.

Whenever a ToO program is triggered, the pre-empting observers shall provide the Telescope Operator and the pre-empted observers with an estimate of the total amount of time the ToO observation will require, including any successive nights if anticipated.

The team triggering the ToO must execute all observations, typically remotely. The scheduled observer or observers whose program has been interrupted are not required to execute the ToO observations. They can, however, assist if asked and if they are willing.

The safety of observatory staff and visiting astronomers is paramount. For this reason Lowell Observatory policy requires that two people are always present at the telescope. On-site scheduled observers whose programs are interrupted by a ToO program are responsible for ensuring that at least one person remains at the telescope with the Telescope operator at all times.

To facilitate ToO observations and real-time decision making, the observatory will provide an up-to-date schedule and list of approved ToO programs on the LDT website (the Science Schedule); remote observing will be done with the standard observing tools, and standard network connectivity for ToO observers to retrieve their data.

In case of changing observing conditions such as variable weather, changing sky brightness, unacceptable seeing or unplanned equipment failure, the ToO observers can opt to terminate their observations at any time and return the telescope to the scheduled observers. Any subsequent time losses shall be borne by the scheduled program as part of normal observing risks once the ToO observers have relinquished the telescope.

If the ToO team triggers a ToO and decides to cancel before the start of the ToO, they **MUST** inform the TO of this. Otherwise, they will be considered to be control of the telescope, and will be charged for the time accordingly. Do not assume that because the weather is bad and the dome is closed that the triggered ToO cancels automatically. It does not.

### 3. TIME ACCOUNTING FOR TOO PROGRAMS AND VALUATION PREMIUM

A partner whose scheduled program is interrupted by a ToO trigger shall not be charged for time during the ToO observations.

The time charged to a ToO observation is based on clock time, which commences either at the start of the night or when the scheduled observer's last full exposure is finished. It ends at the end of the night or when a target of the pre-empted observer's program is reacquired, whichever comes first. Time charged to the ToO includes time for target acquisition, observations, and any desired calibrations.

For time accounting purposes, ToO program usage will be quantized in half-hour units (i.e., ToO observations executed for any portion of a half hour will be charged the entire half-hour period).

The actual time charged for each ToO observation shall be the total usage as calculated above multiplied by a factor of 1.85. This valuation premium is intended to account for the clear-weather advantages given to ToO programs, to compensate partners whose programs are pre-empted by the ToO observations, and to compensate the Observatory for the impact of ToO programs on operations. Of the total time value of 1.85, 1.35 shall be paid to Lowell and 0.5 to the partner pre-empted by the ToO.

### 4. TIME-CRITICAL OBSERVATIONS

The partners recognize the need for occasional time-critical observations (TCOs), such as occultations, exoplanet transits, or joint observations with other facilities which require scheduling at the LDT with the assurance that they will not be pre-empted. By default, ToO programs cannot interrupt TCO programs. However, because some TCOs may have some flexibility, ToOs can request to trigger even when TCOs are scheduled. In such cases, the TCO observer or observers have the final decision on whether or not to allow the ToO interrupt to proceed.

### 5. PRE-EMPTION OF ENGINEERING TIME

ToO programs may be triggered during scheduled engineering time, however the observatory can reject such requests if the ToO observations would create undue interference with planned engineering activities. The final decision on whether to allow a ToO interrupt is up to the Director or their designate, which in most cases will be the lead for the engineering time at the telescope. If ToO

observations are done during engineering time, the time will be charged as described above for a standard ToO.

## 6. PUBLICATIONS RESULTING FROM TOO OBSERVATIONS

Publications resulting from ToO observations should, as a minimum, include an acknowledgement of the interrupted observers.

## 7. REVISIONS TO TOO POLICIES

This document represents the effort to craft policies governing Target of Opportunity programs and Time Critical Observations that balance the needs of all observers, and to implement them in a spirit of goodwill. The success of these policies will be assessed on a continuing basis, and changes implemented as needed in the future.