# POLICY FOR TARGET OF OPPORTUNITY (ToO) OBSERVATIONS AT DCT

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## <u>Overview</u>

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

## The ToO process

- All observing programs that will involve ToO observations must specify them as such in the proposals and quarterly requests delivered to the DCT scheduling committee. These requests shall include all instrumentation requirements. ToO proposals should also specify clearly:
  - 1. the criteria by which the decision to trigger will be made and an estimate of how frequently such criteria are likely to be met.
  - 2. the necessary response time-scale (e.g. immediate, within an hour, next night.)

- 3. 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.
- 4. 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 quarter 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 DCT instrument cube and in their currently available configurations (i.e., no grating changes or swapping filters out are permitted during the night).
- To maximize efficiency and provide rapid response, approved ToO programs can interrupt a scheduled program by phoning the DCT 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.
- 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 willing.
- The safety of observatory staff and visiting astronomers is paramount, and 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 DCT website; 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.

### 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 when the scheduled observer's last full exposure is finished and ends at (1) the end of the night or (2) when a target of the pre-empted observer's program is reacquired, whichever comes first. This 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). Under the assumption that ToO's are randomly distributed throughout the year, and that the average length of a night from the end of evening to the beginning of morning astronomical twilight is 10 hours (ranging from ~8 hours at summer solstice to 12 at winter solstice), the fractional number of nights charged for a ToO observation shall be the number of hours used divided by 10.
- 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.

#### **Time-critical Observations**

The partners recognize the need for occasional time-critical observations (TCOs), such as occultations or exoplanet transits, which require scheduling at the DCT with the assurance that they will not be pre-empted. By default, ToO programs cannot interrupt TCO programs. However, because some TCOs do not require an entire night, 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.

## 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 engineer or commissioning instrument scientist at the telescope. If ToO observations are done during engineering time, the normal time charge, including the additional valuation premium, shall be paid to Lowell Observatory.

#### Publications resulting from ToO observations

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

#### **Revisions to ToO policies**

This document represents a first attempt by the partners to craft policies governing Target of Opportunity programs and Time Critical Observations, 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.