Protected Guaranteed Time Observations - SOXS consortium

The following outlines the SOXS GTO target categories that can be triggered under the GTO program. The policies describing the implementation at the operation level are outlined in the NTT/SOXS Operation Policies document.

Each science category has an allocated number of hours. The allocated hours are larger by a factor of 10% to account for variation in the rates of occurrence and to ensure the total GTO of 180N is delivered, but the GTO will be restricted to the agreed amount.

The sum of all the observing hours dedicated to the four programs below amounts to **1681.9hr**, the remaining 100.1hr to reach 180 nights per year (plus 10%) will be dedicated to a general classification program, to study and classify new sources and to fill the gaps in the observing schedule.

For known transients, we provide a list of objects and the GTO observations block the outburst and not the target itself.

Table 1: **SOXS GTO observations of Supernovae**

Science category	Science constraint	Time*
Gap Transient	Gap Transients yr^{-1} which meet one or more of the following: $m < 19$ & $-5 < M < -15$ Within Local Group and $M < -5$ $d < 50$ and Mpc $M < -15$ SN with precursors and failed SN candidates Has a progenitor in pre-images Visibility > 7 weeks or rising if recently emerged from solar conjunction	**78.8hr**
SN Ia	Type Ia SNe that meet one or more of the criteria: Type SN Ia with $d < 40$ Mpc Any at $d < 15$ Mpc with very high-cadence Nebular spectra with SNR> 20 (within the above) Any SN2002ic-like events Under-luminous or peculiar TN events (e.g. 02cx/02es like) Single spectra of 30 SNe Ia to calibrate the Na I D EW-extinction relation	**93.1hr**
Core-Collapse SN	Core-collapse SNe within $d < 20$ Mpc: photospheric to nebular phase SNe with lines of velocity $v_{\rm FWHM} <$ few $\times 10^3$km/s - ~ 7 spectra per target Very luminous type II and Ibc SNe: $-20 < M_p < -19$ & $z < 0.05$ SN2022jli-like: lightcurve variability indicating binary progenitors ($\gtrsim 3\sigma$ peak-to-peak) Any CCSNe found within < 2.5 kpc from centre of LIRG (rare, expect ~ 1yr^{-1})	**170.2hr**
Super-luminous SN	H-poor SLSN at redshifts $z < 0.1$ H-rich SLSN with broad lines at $z < 0.15$ iPTF14hls-like supernovae - very long-lived ($\gtrsim 100$ d)	**59.1hr**
Galactic SN	Any SN within the Galaxy - high frequency observations	

* **The total requested time is 401.2hr**.

Table 2: **SOXS GTO on early observations of supernovae: shock breakout, cooling and Fast Blue Optical Transients**

Science category	Constraints	Time*
Early SN	Rapid response to SNe that are discovered young, defined by: Host galaxy within $d < 100$ Mpc and has a non-detection 2d before For sources with $d < 20$Mpc, infancy criteria relaxed to 7d before	**320.1hr**
FBOT	Fast blue object transients - defined as below t$_{rise} < 5$ d, $M < -19$, $T_{BB} > 10,000$ K, t$_{half} \lesssim 7$ d And/or has non-thermal x-ray and radio emission Spectroscopic observation of FBOT Flares - as observed in AT2022tsd	**142.3hr**
Luminous Fast Coolers	Transients that are luminous and fast cooling, defined by: Host galaxy that implies $M < -20$, plus rapid cooling (roughly $T \sim 1/t$)	**17.8hr**
Fast extragalactic transients	Rapid response to extragalactic fast declining sources: Timescale above have maximum luminosity of t$_{half} \lesssim 5$ d AT2018kzr-like (WD-BH merger): blue and fast declining	**17.8hr**

* **The overall time request is 498.0hr**.

Table 3: **SOXS GTO on extragalactic transients (excluding SNe)**

Science category	Trigger. mag	Constraints	Time*
BL Lac	–	TeV flare	
FSRQ	–	Flux 0.1-100 GeV, $> 1 \times 10^{-7}$ ph cm^{-2} s^{-1}	**30.5hr**
(A/E)NT	$M < -20$	or $t_{\rm rise} > 20$ d (nuclear)	
TDE Candidate	$r < 20$	classify all sources that are blue, rising, nuclear	**138.1hr**
TDE follow-up		confirmed TDE	
Long GRB	$r < 21$ or $H < 19$	High energy trigger or afterglow - spectrum	
Long GRB	$r > 21$	High energy trigger or afterglow -photometry	
GRB-SN	$r < 21$ or $H < 19$	High energy trigger or afterglow $z \lesssim 0.2$	
Short GRB	$r < 21$ or $H < 19$	High energy trigger or afterglow - spectrum	
Short GRB	$r > 21$	High energy trigger or afterglow - photometry	**247.5hr**
(FXT)	$r < 21$ or $H < 19$	High energy trigger or afterglow - spectrum	
(FXT)	$r > 21$	High energy trigger or afterglow - photometry	
GW/Kilonova spectrum	$r < 21$	GW/Kilonova detection not connected to SGRB	
GW/Kilonova photometry	$r < 24$	GW/Kilonova detection not connected to SGRB	**52.0hr**
HEN Neutrino	$r < 21$	Gold HEN & counterpart	

* **The overall time request is 468.1hr**.

Table 4: **SOXS GTO observations of Galactic transients**

Science category	Trigger. mag	Constraint	Time*
NEO	$V < 20$	Orbit $< 1.5''$ (3σ) $D < 300$ m	
Cometary body	$V < 20$	Orbit $< 1.5''$ (3σ) $r_{init} > 5$ au $q < 3$ au	
FRT - Active Asteroid	–	Detection of eject/coma + comet trigger	**64.4hr**
FRT - Interstellar	–	$e > 1$ (3σ)	
158 TESS cand. (see list)	$V < 11$	Two measurements in windows close to quadrature	
60 HJ transit	$V < 13$	Two transits from a sample of HJs	**64.6hr**
RR Lyr	$V < 18$	Obs. during hump, bump and quiescent phases	
Eruptive Young stars	$V < 18.5$	$mag_{\rm alert} - mag_{\rm histo} > 3\sigma$	**46.6hr**
Dwarf Nova outburst	$V < 18$	DN outburst alert from optical surveys (sample of 12)	
Gal or extragal. Nova	$V < 19$	Nova outburst alert from optical surveys within 3 Mpc	
WZ Sge outburst	$V < 19$	Outburst alert from optical surveys of WZ Sge	**83.4hr**
White dwarfs	$V < 19$	Irregular transits of planetary debris from LAST & Rubin	
Magnetar	$r < 21$	High energy outburst or flare	
Swift J195509+261406-like	$r < 21$	High energy or optical flare	
Type II X-ray pulsar outburst	–	$L_{\rm X} > 5 \times 10^{37}$ erg s^{-1}	**55.6hr**
Transitional MSP	–	State change	
NS-LMXB outburst	$i < 20.5$	Optical/quiescence($\Delta m > 1$) or X-ray alert	
BH-LMXB outburst	$i < 20.5$	Optical/quiescence ($\Delta m > 1$) or X-ray alert	

* **Overall time 314.6hr.**