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# THE SOXS GTO PROGRAM

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# WHERE DO WE START FROM?

SOXS GTO is made of 180 nights /yr for 5 years

1 night = 9 hr

Observing efficiency (shutter open) ~ 70%

We will share with ESO bad weather (~20% of the nights, 10% on SOXS)

Classification program (~10%)

920 hr per year on source



# SOXS GTO TIME SHARE

INAF	49%
Weizmann Institute	24%
Queen's Univ. Belfast	8%
Finland	7%
Chile	6%
Tel Aviv University	4%
DAWN & Aarhus Un.	2%



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# SOXS-GTO BROAD CHARACTERISTICS

The SOXS GTO is entirely dedicated to time-domain astronomy

All observations are “Target of Opportunity” (TOO) observations

GTO proposals (generic target description, trigger criteria) are submitted through normal ESO calls and reviewed by the OPC. The protected science cases are made public ahead of the call for proposal for open time. The SOXS consortium data will be public after a one-year proprietary period, as normal ESO data.



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# POLICIES

TOOs will be accepted on the ESO-community time, too

ESO-TOO can be triggered within a given time of the day. In case of conflict between triggers for the same target, a trigger from a GTO program has priority over any non GTO trigger.

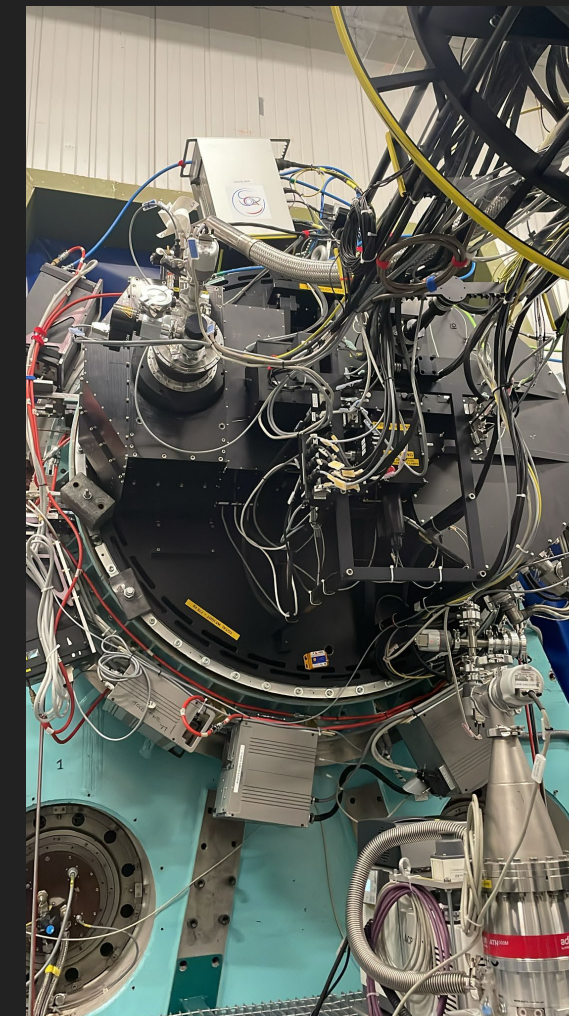
Community proposals will be allowed to request an overlap of science cases with GTO with the understanding that they would only be observed either if GTO did not trigger on that object or when the GTO time approved by the OPC based on the submitted proposals of the same category within the period is exhausted.

The nightly schedule is defined before the start of the observing night. The SOXS consortium assesses which ToO (community or consortium) should be observed within the allocated times, technical feasibility, conditions, and in compliance with the trigger approved by the OPC. ToO (community or consortium) observations get priority over normal (non-ToO) runs until the allocation time has been reached.

# SOXS CHARACTERISTICS

SOXS is our favourite instrument,  
but around there are spectrographs:

- mounted on bigger telescopes
- with wider band coverage
- with higher resolution
- with multi-object capabilities



- Single-object spectrograph (0.5", 1", 1.5", 5" x 12" slit)

- Broad band (350 - 2000 nm)

-  $R \sim 4500$  (4000-6000)

Acquisition camera for photometry (uvizX-2.5x2.5, 0.2" pixel)

... HOWEVER

# SOXS PECULIARITIES HOW SHOULD WE USE SOXS IN THE BEST WAY?

SOXS GTO time: 180 nights/yr for 5 years

SOXS GTO is completely dedicated to transient astronomy (all obs. are TOO's)

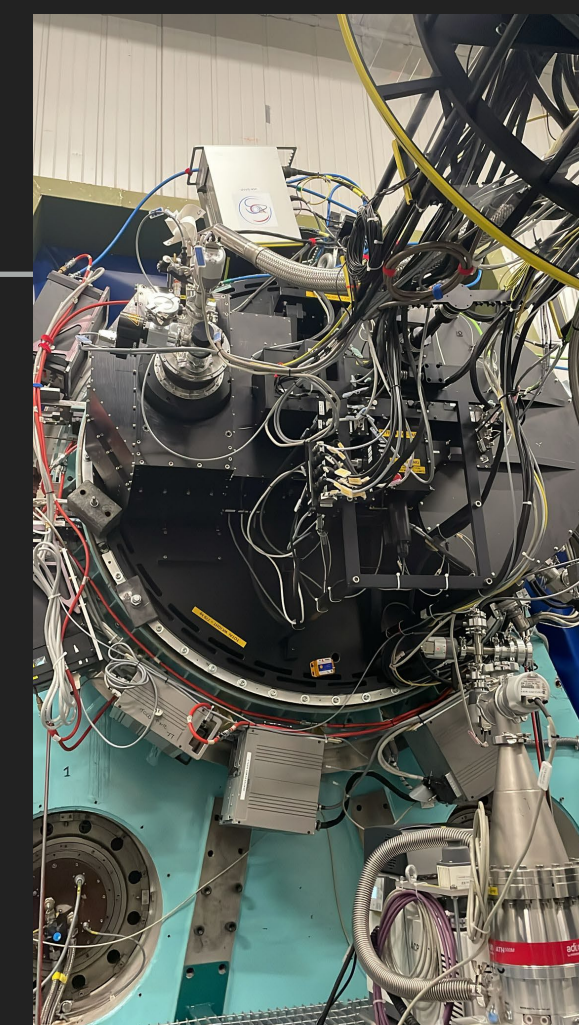
SOXS is always mounted

The consortium has to run the operations (produce the schedule every single night with the possibility to change it on the fly)

The observing schedule is completely dynamic, with no pre-allocated nights

The consortium will have a reaction team for urgent observations (human RRM mode) + automation

**PROMPT OBSERVATIONS - COMPLETE SAMPLES - EXTENSIVE OBSERVATIONS**





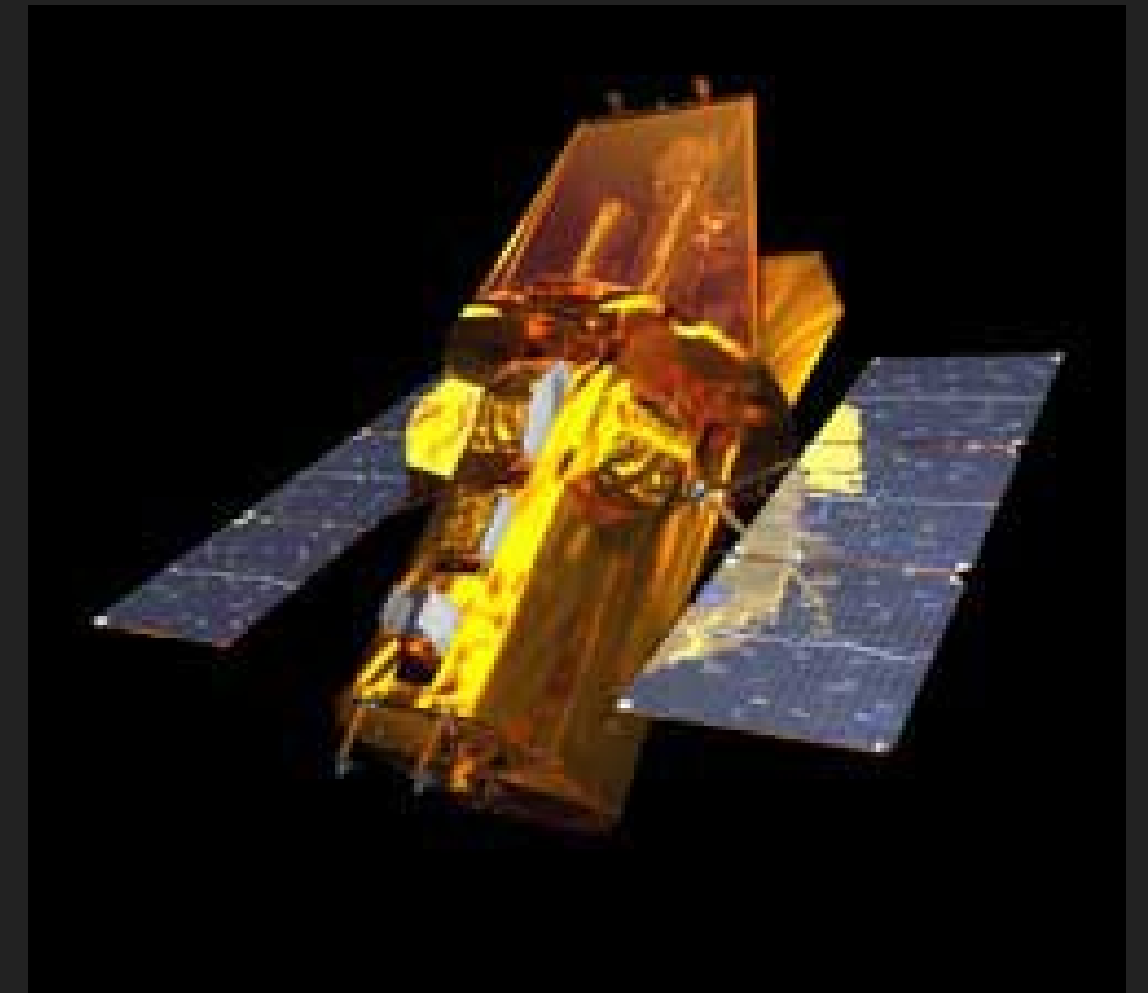
# SIMILARITIES WITH SWIFT

As for Swift, it is difficult to identify a unique science case

Swift Heritage: every working day, we will have a telecon to fix the schedule (a different one)

... to be disrupted soon by a new GRB/GW/SBO/whatever

Synergies with Swift: GRB, SNe, etc., X-ray and UV coverage





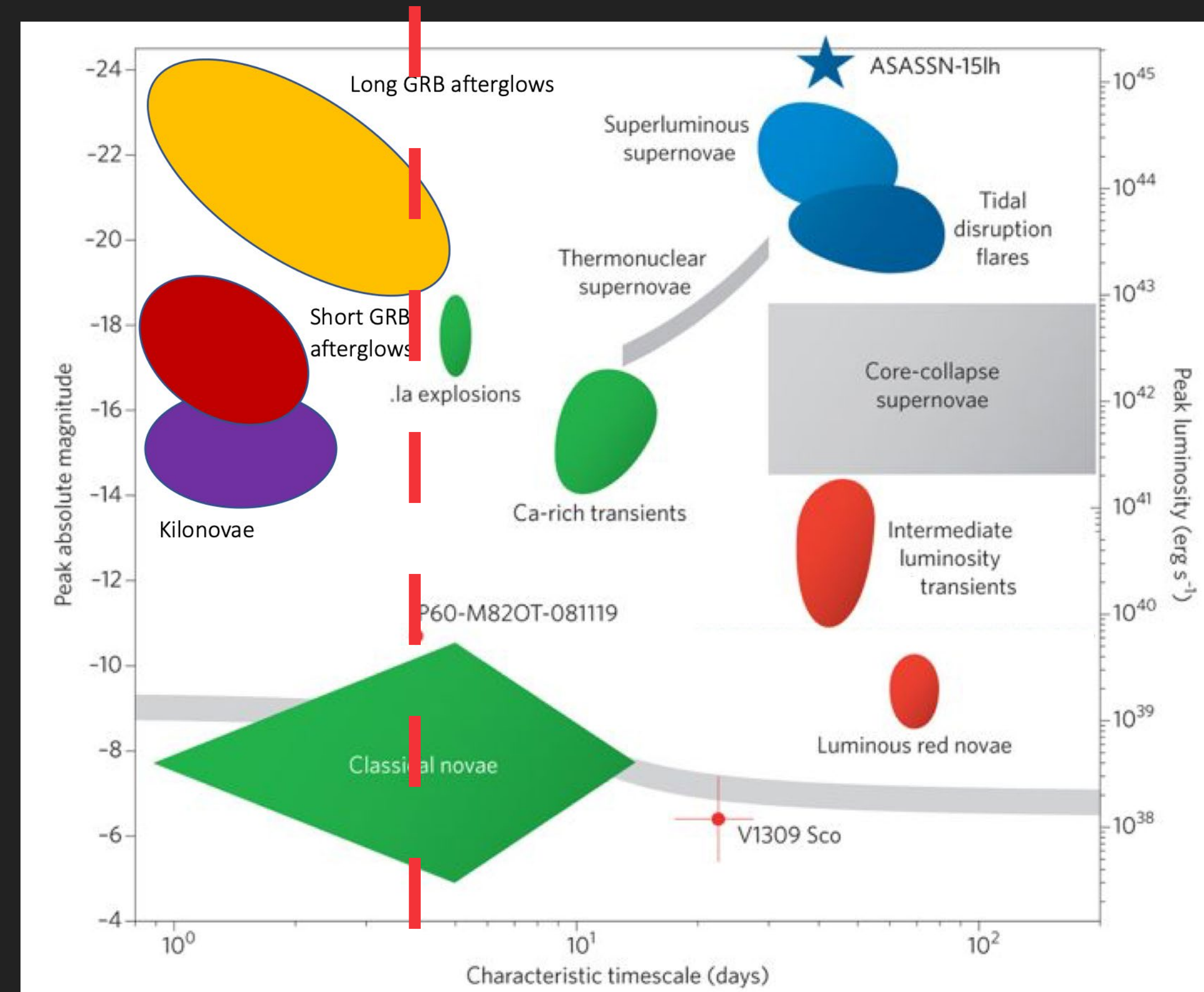
## SOXS SCIENCE

- ▶ CLASSIFICATION (~10%)
- ▶ SN (ALL FLAVOURS)
- ▶ GW &  $\nu$
- ▶ TDE & NUCLEAR TRANSIENTS
- ▶ GRB & FRB
- ▶ BLAZARS & AGN
- ▶ X-RAY BINARIES & MAGNETARS
- ▶ NOVAE & WDS
- ▶ YOUNG STELLAR OBJECTS & STARS
- ▶ ASTEROIDS & COMETS

UNKNOWN

Use at BEST our STRENGTHS:

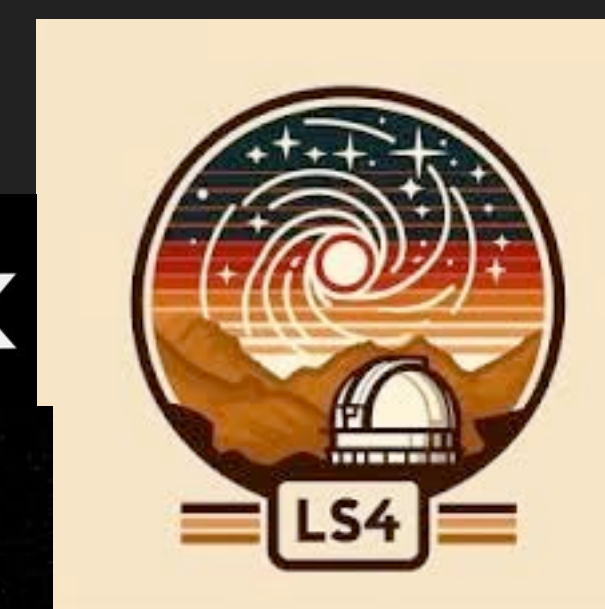
- Rapid follow-up
- Always available (complete sample, dense monitoring)





# NEED FOR FOLLOW-UP (EVERYONE NEEDS A REDS LEAST)

CURRENT & NEW OPTICAL SURVEY: ZTF, LS4, LAST, RUBIN  
SPACE OPTICAL/NIR MISSIONS: EUCLID, ULTRASAT, UVEX  
SPACE HIGH-ENERGY MISSIONS: SWIFT, FERMI, SVOM, COSMOS, ...  
RADIO NEW FACILITIES: MEERKAT, SKA, ...  
VHE: MAGIC, HESS, CTA  
MESSENGERS: LIGO-VIRGO, KM3NET, ...





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# THE SOXS GTO PROGRAM CONSISTS OF FOUR PROPOSALS

Galactic Transients

Early Supernovae

Supernovae and Related Objects

Extragalactic Transients



# GALACTIC TRANSIENTS

Transient Solar System Objects

Exoplanets and Planetary Transits

Stars

White Dwarfs

Compact Objects

Object
NEO
Cometary body
FRT - Active Asteroid
FRT - Interstellar
158 TESS cand.
60 HJ transit
RR Lyr
Eruptive Young stars
Dwarf Nova outburst
Gal or extragal. Nova
WZ Sge outburst
White dwarfs
Magnetar
Swift J195509+261406-like
Type II X-ray pulsar outburst
Transitional MSP
NS-LMXB outburst
BH-LMXB outburst

19% of GTO time

# EARLY SUPERNOVAE

Core – Collapse Supernovae

Fast Blue Optical Transients

Object
<b>CC-SN</b>
<b>FBOT</b>

30% of GTO time

# SUPERNOVAE AND RELATED OBJECTS

Gap Transients

SNe Ia

Core – Collapse SNe

Super-luminous SNe

Galactic SN

Object
Gap Transient
SN Ia
Core-Collapse SN
Super-luminous SN
Galactic SN

24% of GTO time



# EXTRAGALACTIC TRANSIENTS

BL Lacs and FSRQs

Nuclear Transients

Tidal Disruption Events

Gamma-ray Bursts / Fast X-ray Transients

GW & Neutrino Multi-Messenger Astronomy

Object
BL Lac
FSRQ
ANT
TDE Discovery
TDE follow-up
Long GRB
Long GRB
GRB-SN
Short GRB
Short GRB
(FXT)
(FXT)
GW/Kilonova spectrum
GW/Kilonova photometry
HEN Neutrino

28% of GTO time

# CONCLUSIONS – TAKE HOME MESSAGES

see you soon!

- ▶ SOXS GTO time: 180 nights/yr for 5 years
- ▶ SOXS GTO is completely dedicated to transient astronomy (all obs. are TOO's!)
- ▶ SOXS is always mounted
- ▶ The consortium have to run the operations (produce the schedule every single night with the possibility to change it on the fly)
- ▶ The observing schedule is completely dynamic, with no pre-allocated nights
- ▶ The consortium will have a reaction team for urgent observations (human RRM mode) + automation
- ▶ Science policies document for handling GTO – ESO community observations
- ▶ **PROMPT OBSERVATIONS - COMPLETE SAMPLES - EXTENSIVE OBSERVATIONS**

