

# Roman/Subaru Synergistic Follow-up of RAPID-discovered transients

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Subaru Instrument: Prime Focus Spectrograph (PFS)

Number of nights (hours):  $15+12+2 = 29$  partial nights (approx. 2,304,000 fiber hours)

Condition of nights (moon phase, airmass, seeing): any phase, airmass  $< 2$ , seeing  $< 1.5''$

Time critical (year, season, date, time): When northern HLTDS and GBTDS fields (TBD) are alternately accessible; also, the few (if any) northern GAS fields for which time domain is possible

Relevant CCS/other Roman program: SN PIT, RGES PIT, HLTDS & GBTDS CCS, and STRIDE WG

Category (exoplanet, galaxies, large scale structure, solar system, stellar physics, stellar population/ISM, super massive blackhole/AGN, IGM/CGM ): stellar physics

Key words: Roman, time domain astronomy, alert streams, transients, variables, supernovae, superluminous supernovae, tidal disruption events, novae, stellar eruptions



**Roman Alerts Promptly from Image Differencing**  
will enable time domain astronomy from every  
Roman imaging observation

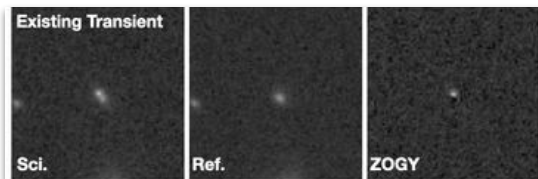
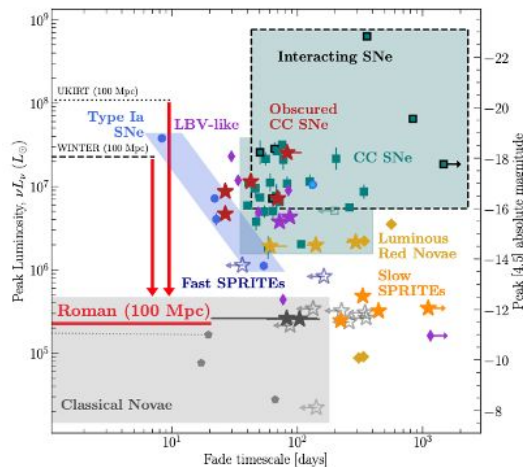


Image differencing pipeline

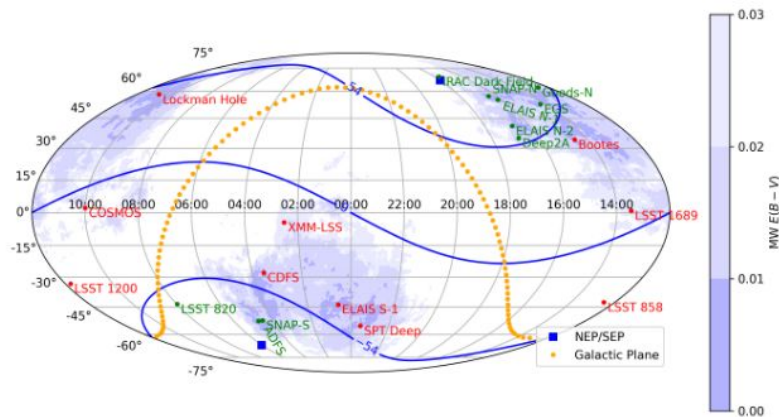


*Public Alert Stream  
including all types of transients,  
variables and moving objects*



1000's of infrared transients  
discovered over every  
Survey field observation  
over a large range of redshift  
throughout the Roman mission

# High Latitude Transients



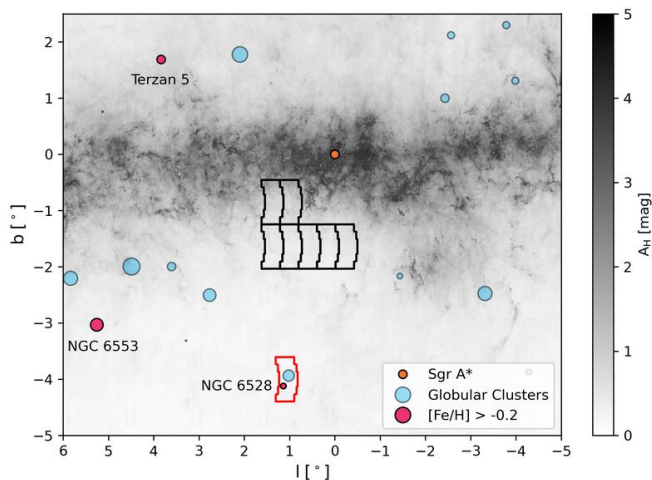
Possible fields for the Roman CCS HLTDS  
(Rose+2023, CCS WP); final field selections TBD

- Supernovae (Ia, core collapse)
- Luminous red novae (Mergers, Common Envelope Ejections)
- LBV massive star eruptions
- Tidal disruption events
- AGN flares
- Superluminous supernovae
- Pair-instability supernovae

We would use all available science fibers to obtain classification spectra of every possible transient with  $J \lesssim 23$  mag with multiple footprints to cover the northern HLTDS every  $\sim 4$  weeks

*Priority Order (High to Low): Classification of new live transients; multiple epochs of known transients; amplitude-ranked list of variable stars; if detected, host galaxy properties*

# Galactic Bulge Transients



Possible fields for the Roman CCS GBTDS (Grunblatt+2023); final field selections TBD

- Eruptive YSOs (FUors, EXors)
- “Dipping giants”
- Classical novae
- Recurrent novae
- Dwarf novae
- Cataclysmic variables
- M dwarf flares
- Microlensing events

We would use as many science fibers as required ( $\sim 1000?$ ) to cover every transient with  $J \sim 10\text{--}22$  mag for 7–9 GBTDS fields during all 6 seasons of the Survey

# Summary

- On behalf of the entire Roman time domain community, we propose a systematic magnitude-limited PFS follow-up program, covering the full range of transients discovered by the RAPID pipeline in the northern HLTDS, the entire GBTDS, and select northern GAS fields
- (*Which GAS will enable TDA, if any, is currently unknowable*)
- Exptime (4 x 900 s) estimates driven by the NIR spectrograph
- We plan to use up to the full complement of available science fibers
- The two main sets of fields are complementary in terms of scheduling
- We estimate that this program would require **15+12+2 partial nights** , spread out over the 6 months (in 2 years) of HLTDS, 6 x 72-day seasons of GBTDS, and 5 yrs of GAS
- The program would be designed and executed in collaboration with the SN PIT and RGES PIT, STRIDE WG, and the Roman TDA community