The KMTNet Supernova Program: Some Recent Examples

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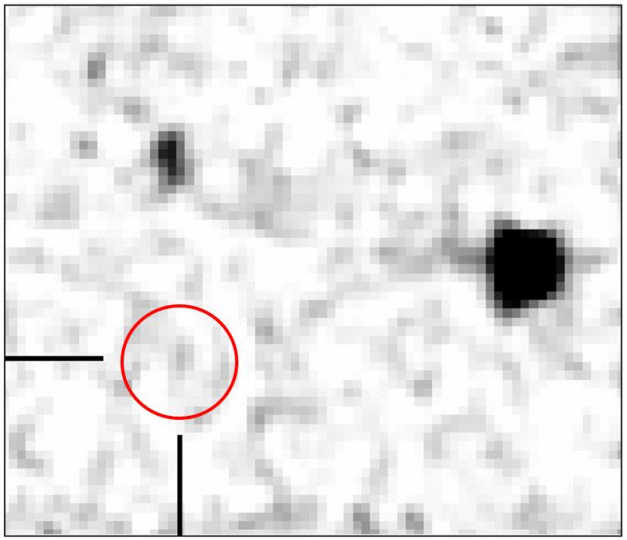
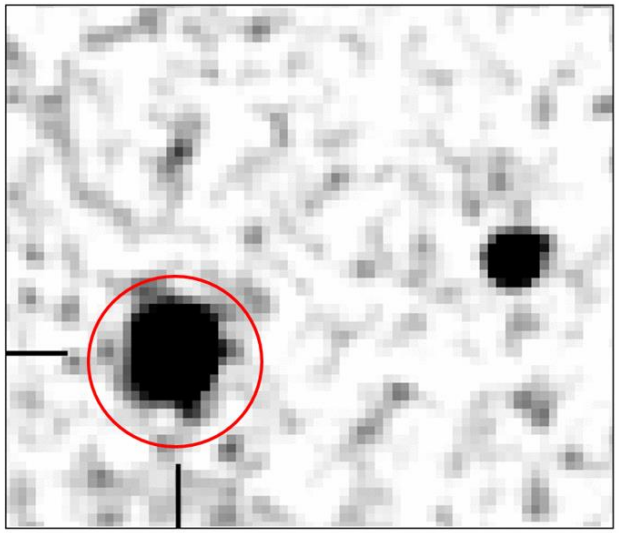
KMTNet Supernova Program (KSP)

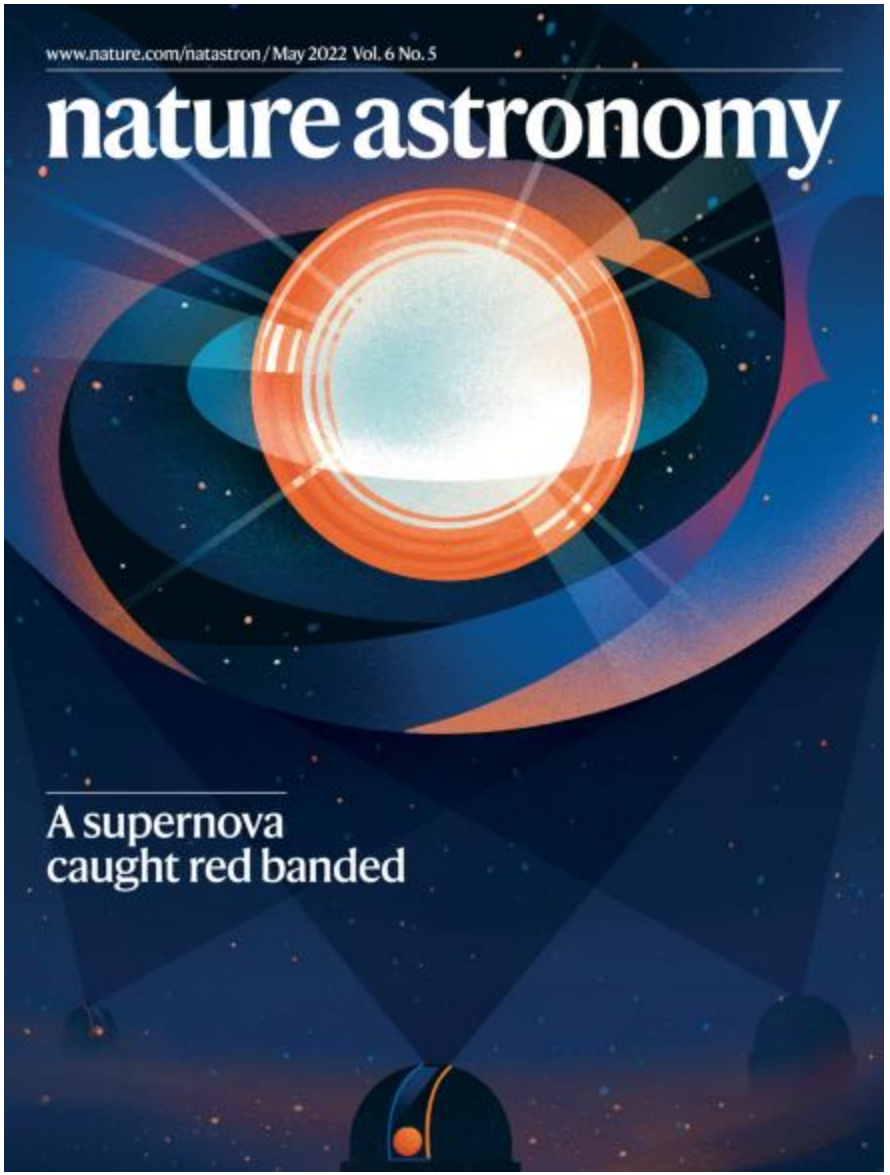
Main Scientific Objectives:

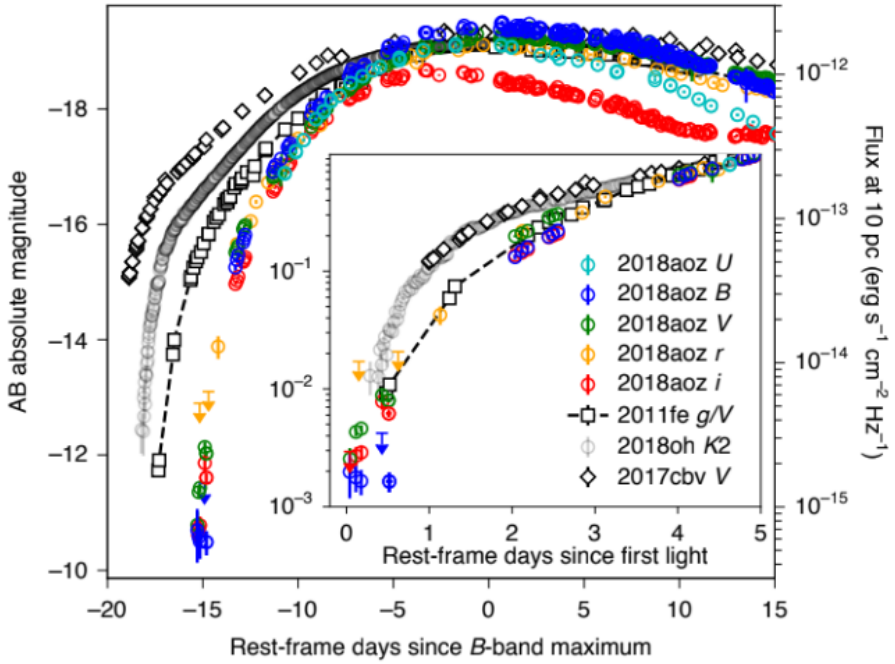
- ✓ Infant/Early (stellar) explosions (focusing on supernovae)
- ✓ Fast, rare optical transients, including optical counterparts of G-wave sources
- ✓ Various types of variable objects
- ✓ Low surface brightness objects (e.g., dwarf galaxies)
- ✓ And something serendipitous and unforeseen

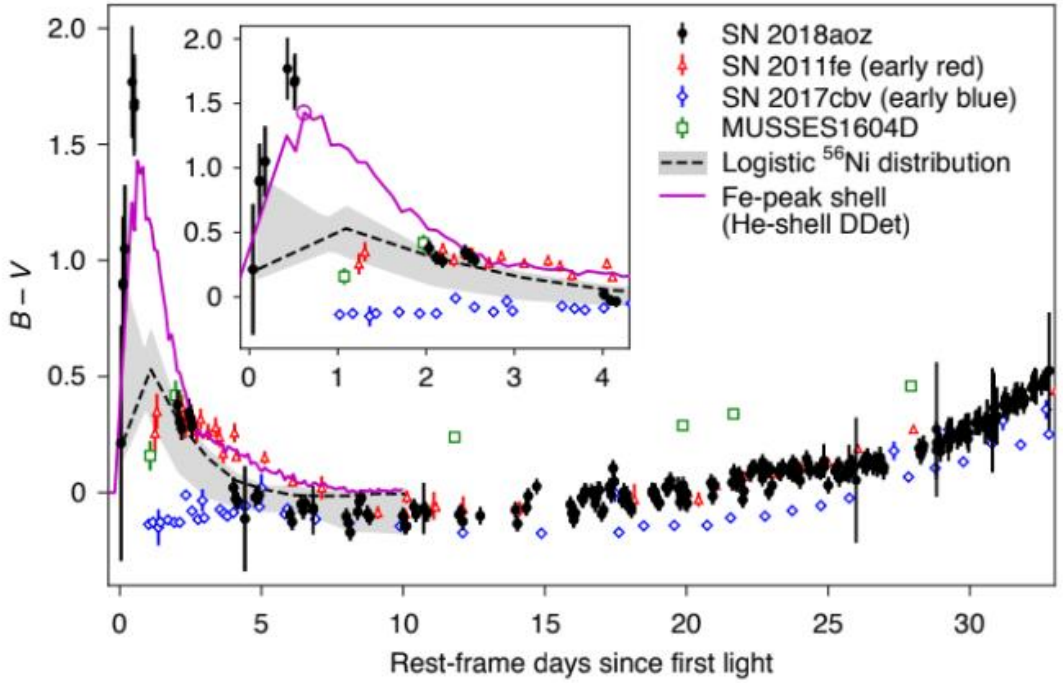
SN2018aoz: KSP detection of the earliest (= 1 hour after explosion) Type Ia SN (Ni et al. 2022, Nature Astronomy, 6, 568)











Infant **reddening** detected by the KMTNet requires the presence of surface Fe elements when normal Type Ia SNe explode

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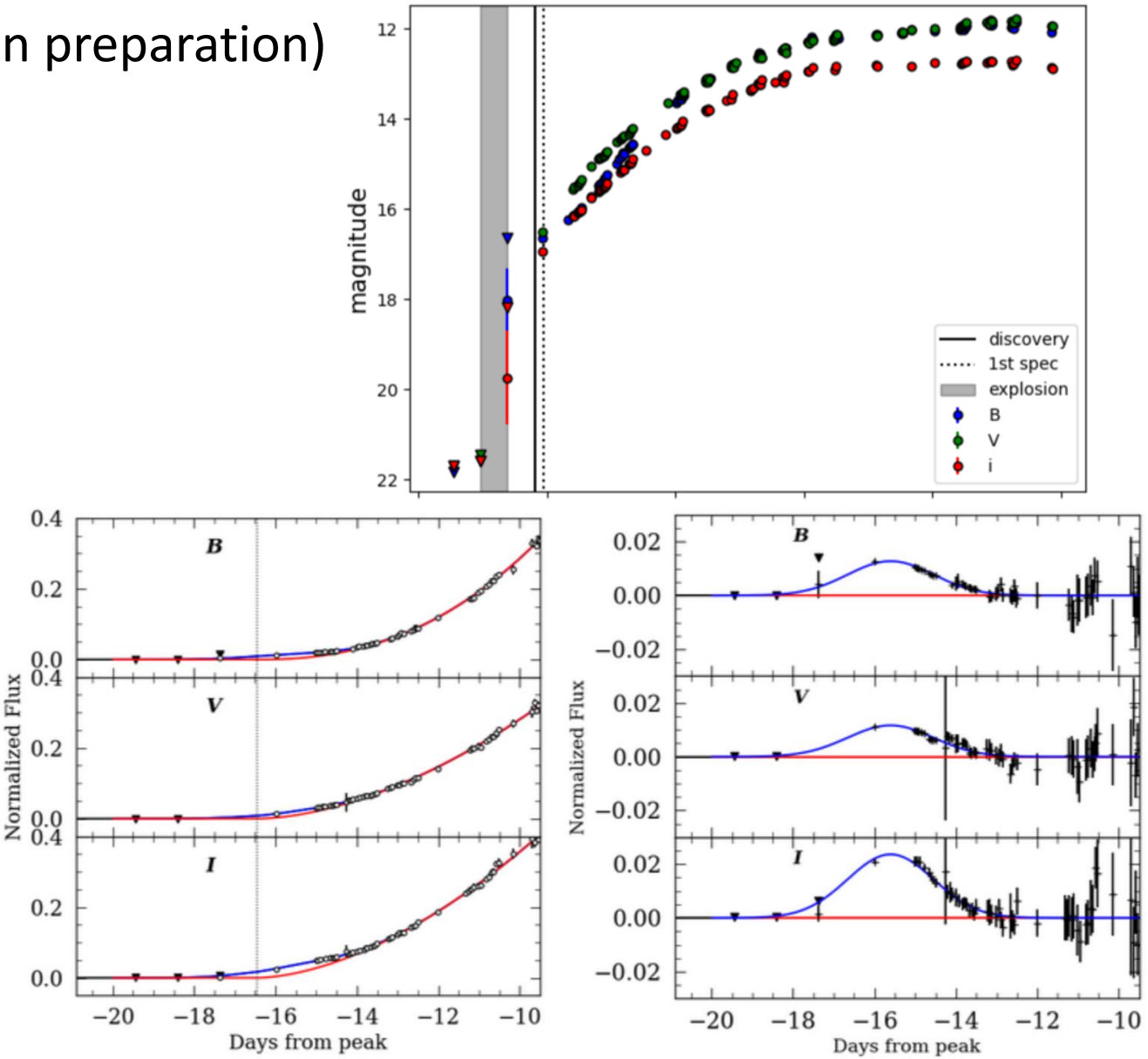
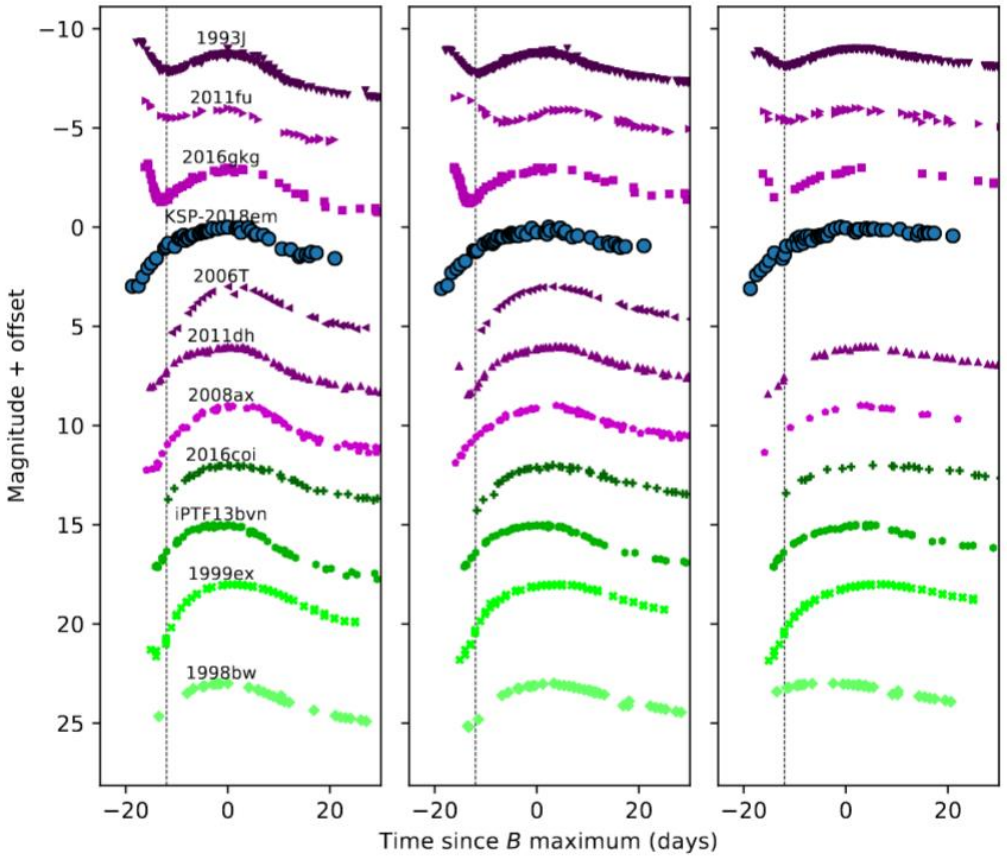
Surface nuclear burning or subsonic mixing during Type Ia SN explosion processes.

A new KSP-discovered Type Ia provides the first confirmation of shocked early excess emission

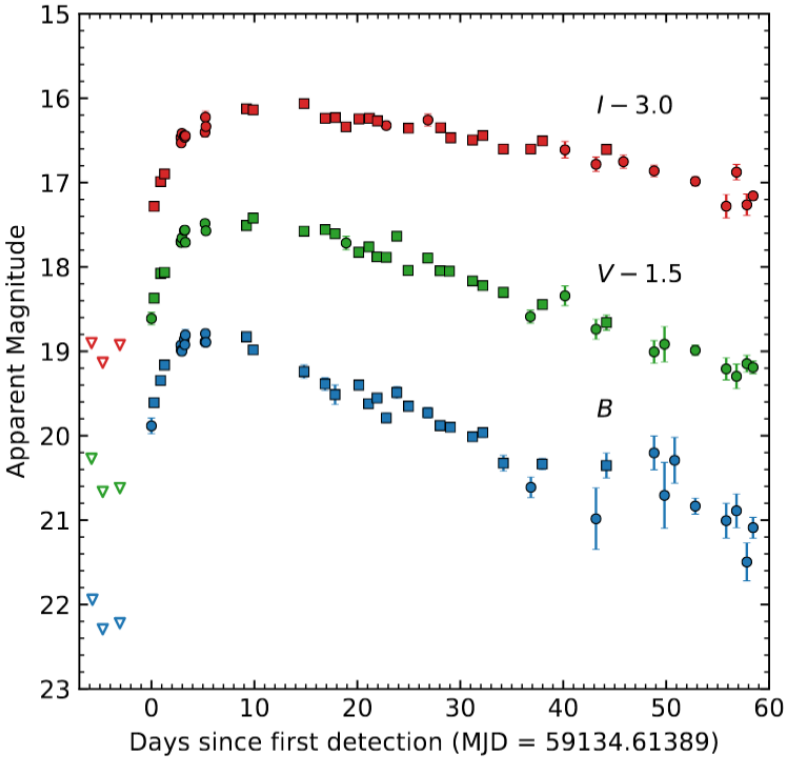
(Ni et al. in preparation)



KSP-discovered core-collapse supernovae examples



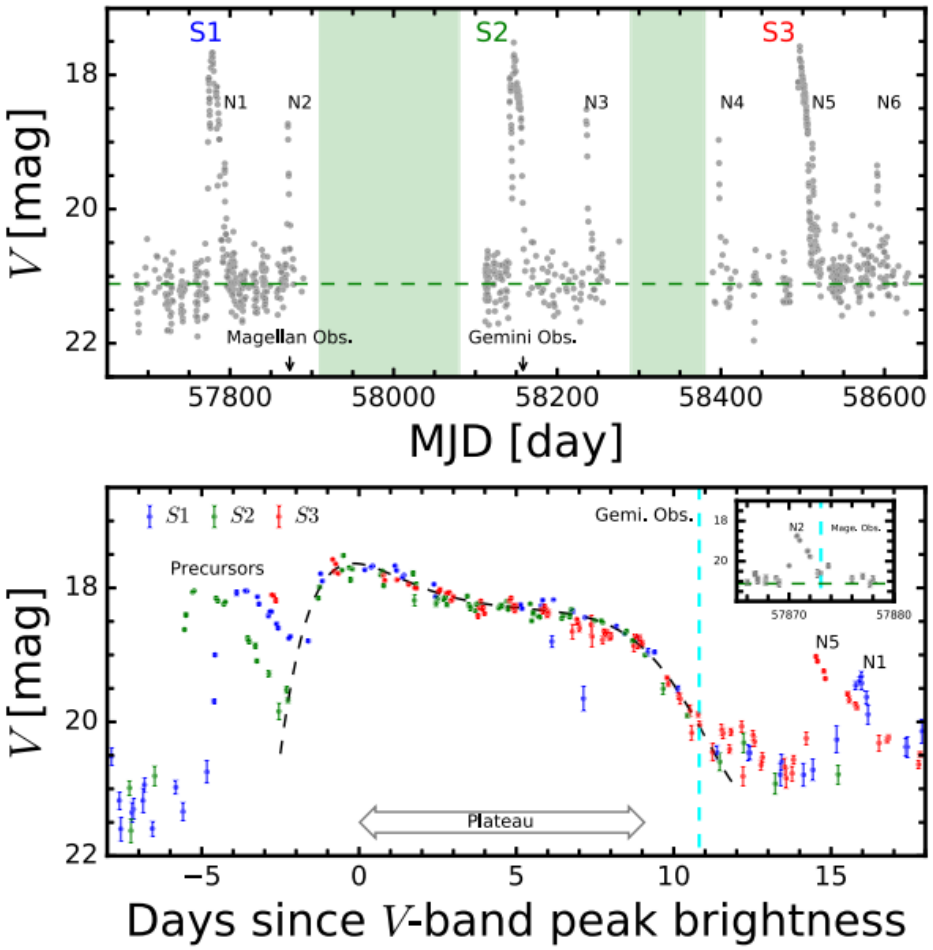
Transitional core-collapse between Type IIb and Ib (Xu et al. 2022)

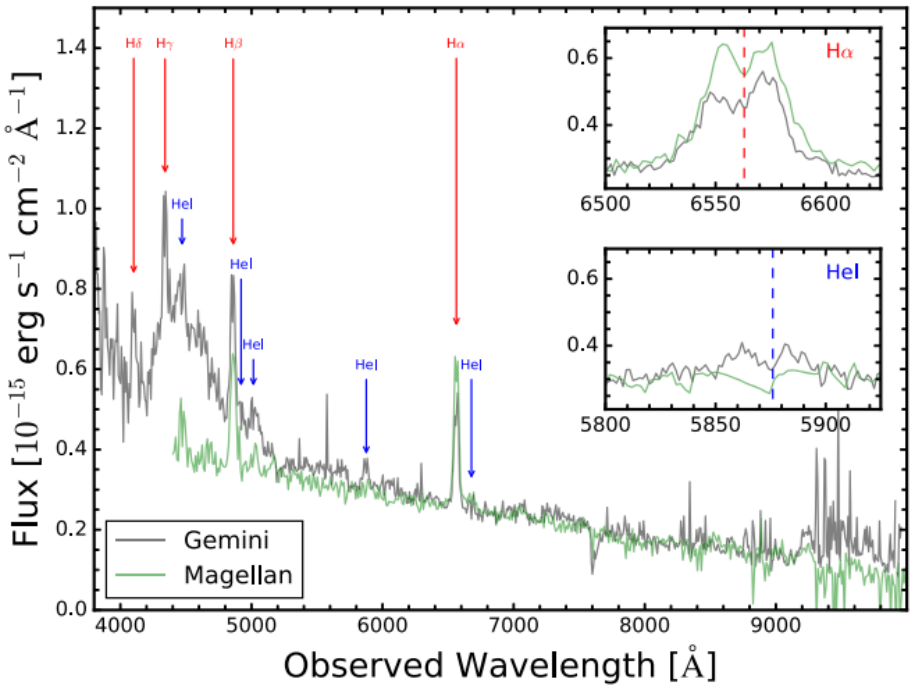


Rare infant-phase detection of a Type IIL supernova (Sandoval et al. 2022)

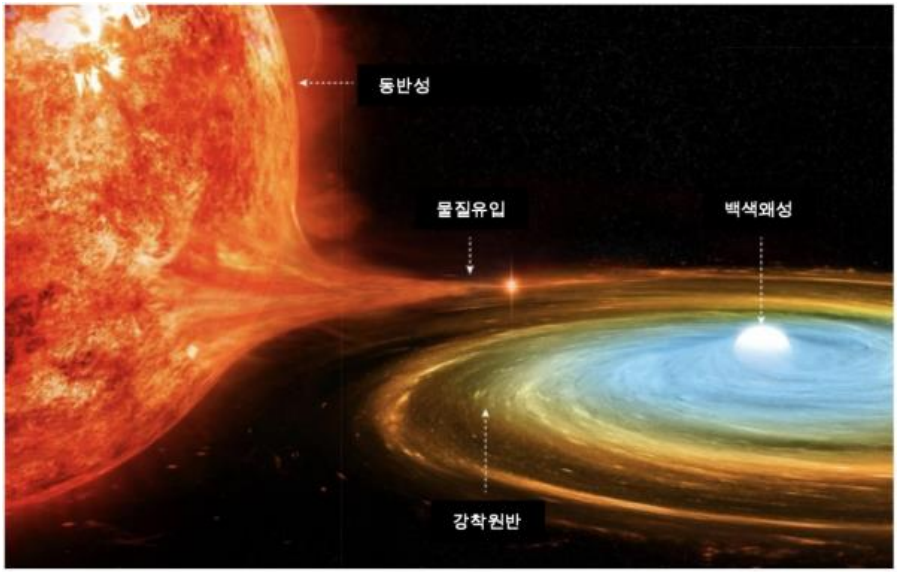
KSP-OT-201701: First-ever discovery of a short-period, unusually He-deficient dwarf nova by the KMTNet

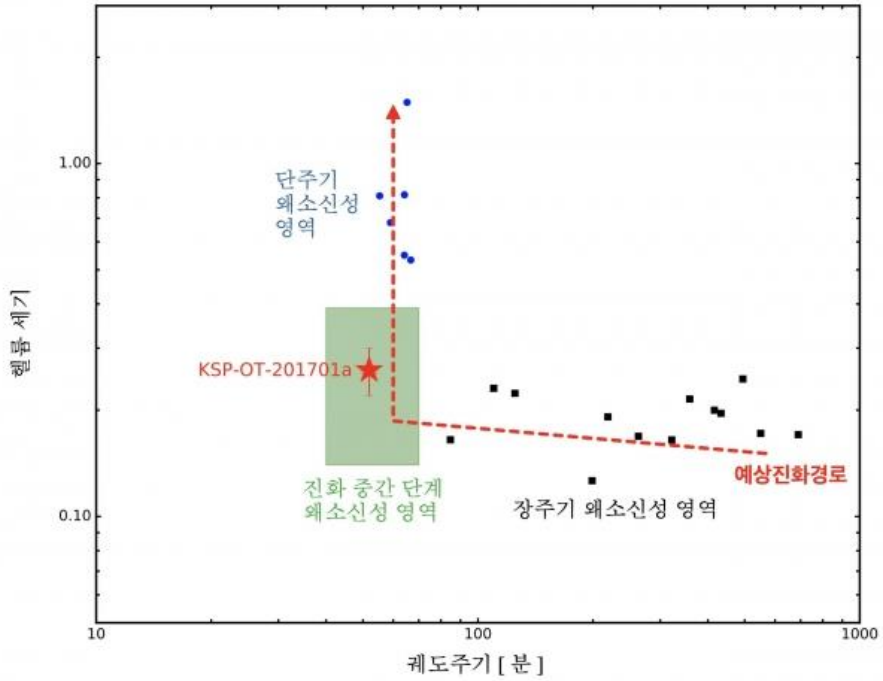
(Lee et al. 2022, ApJ, 925, 22L)





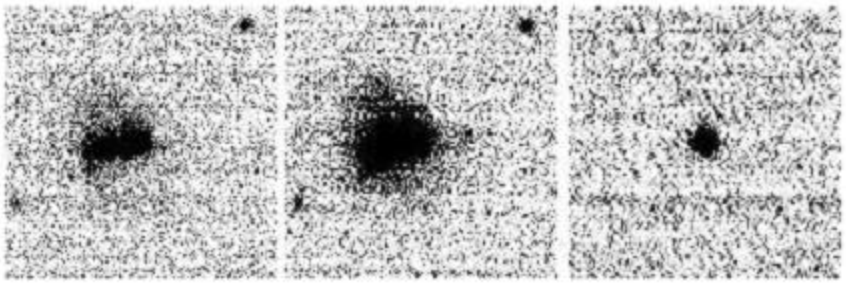
KSP-OT-201701a: First-ever discovery of a short-period, unusually He-deficient dwarf nova by the KMTNet



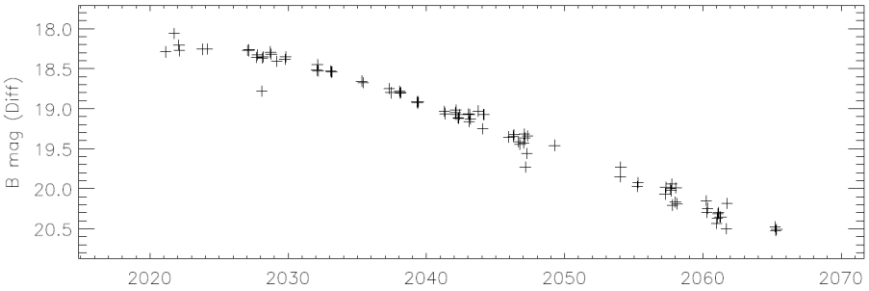


The short orbital period, which is under the period minimum, the unusual helium deficiency, and the large mass ratio suggest that KSP-OT-201701a is **a transition object** evolving to an He CV from a long-period dwarf nova with an evolved secondary star.

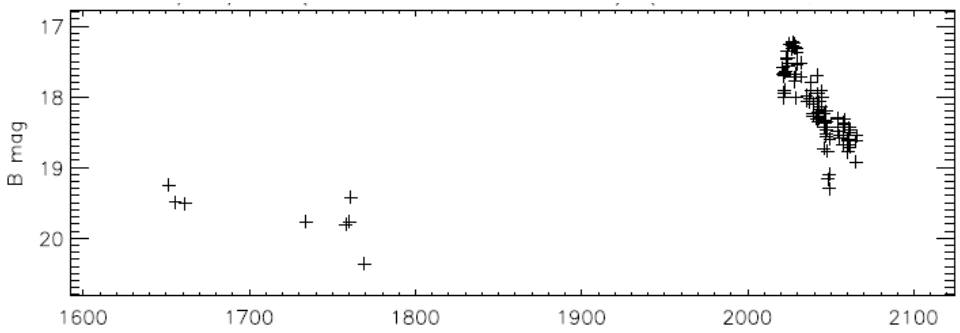
Or, something that is totally unexpected …….

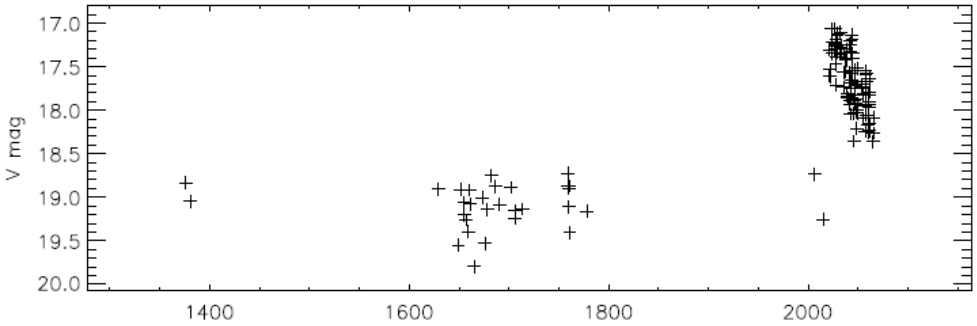


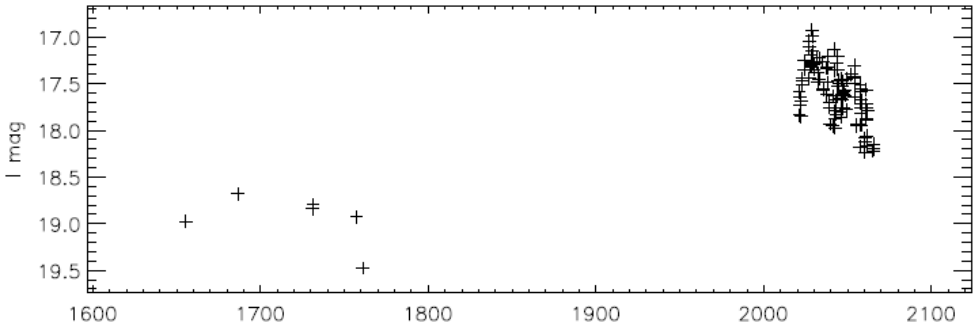
After image subtraction



Gradual decay

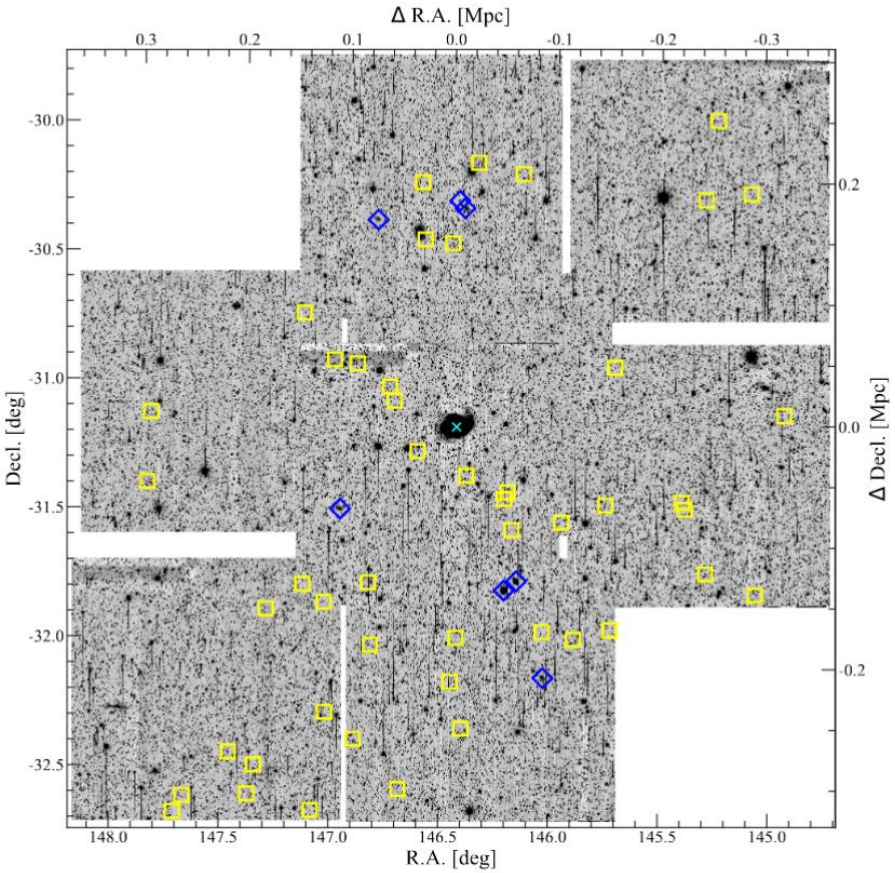




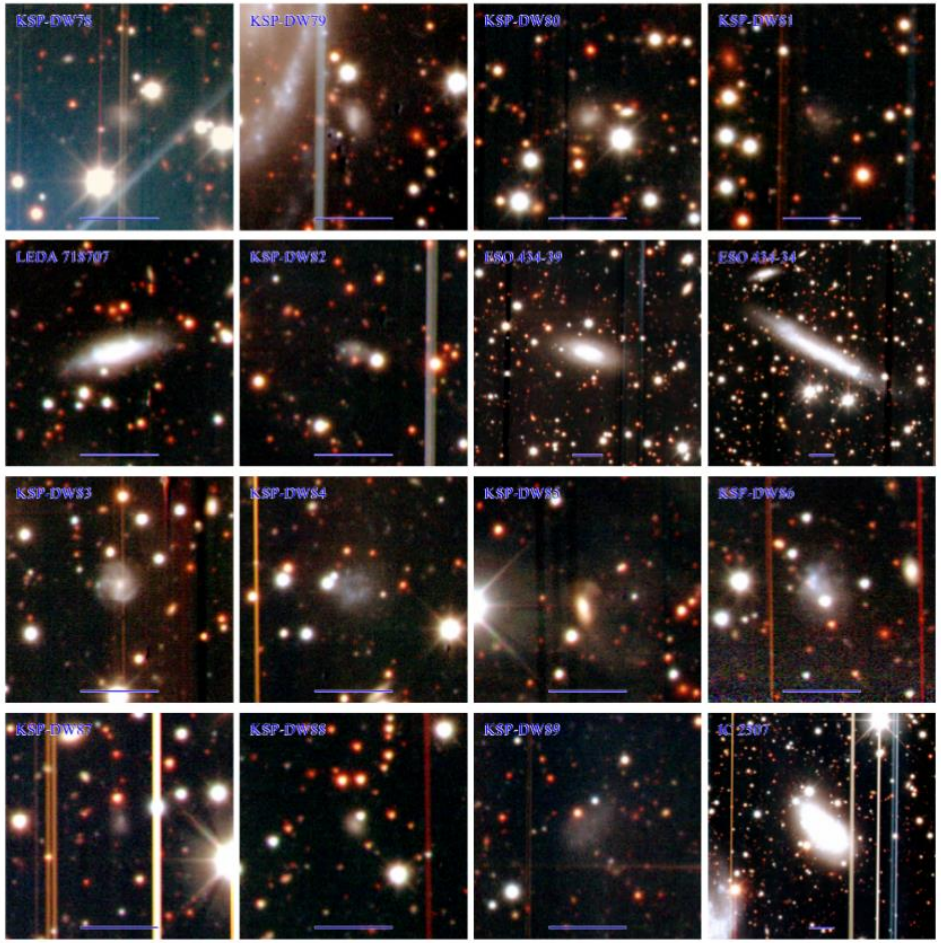


Long-term light curves

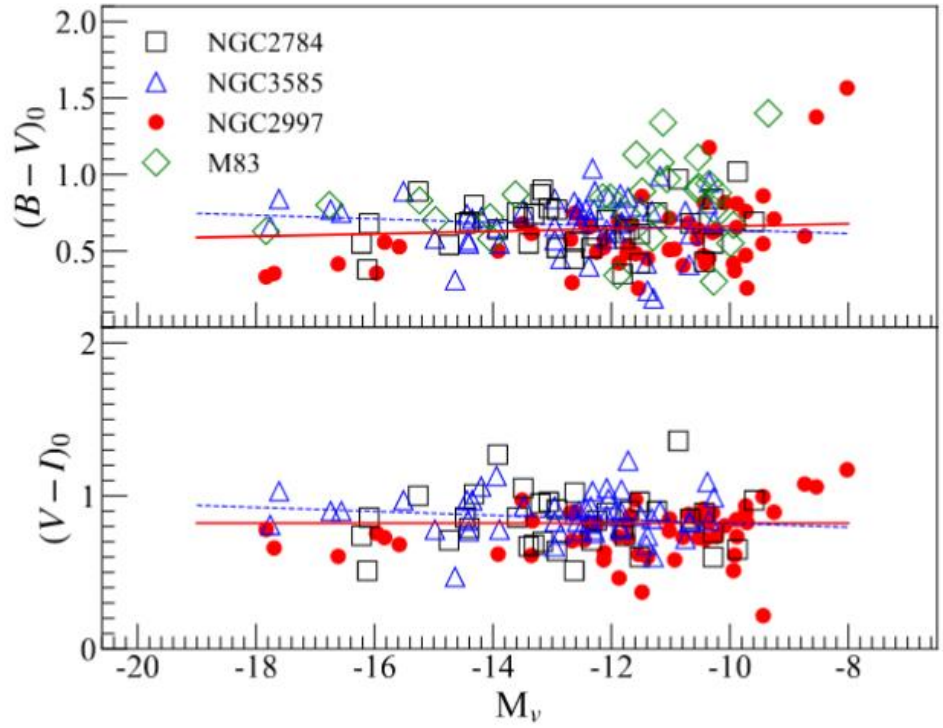
(Continued) KSP exploration into low-surface brightness objects, focusing on dwarf galaxies

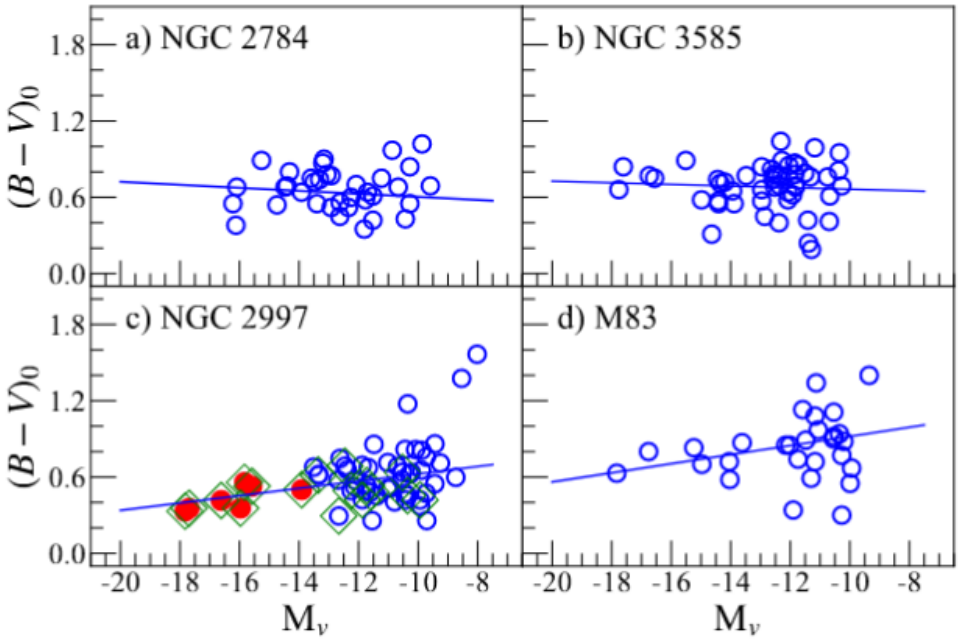


KSP-stack image of NGC 2997 (Fan et al. 2022)



Deep, stacked images keep providing discoveries of numerous dwarf galaxies





Different types of color-magnitude diagrams of KSP-discovered dwarf galaxies, depending on the host galaxy types and evolutionary stage

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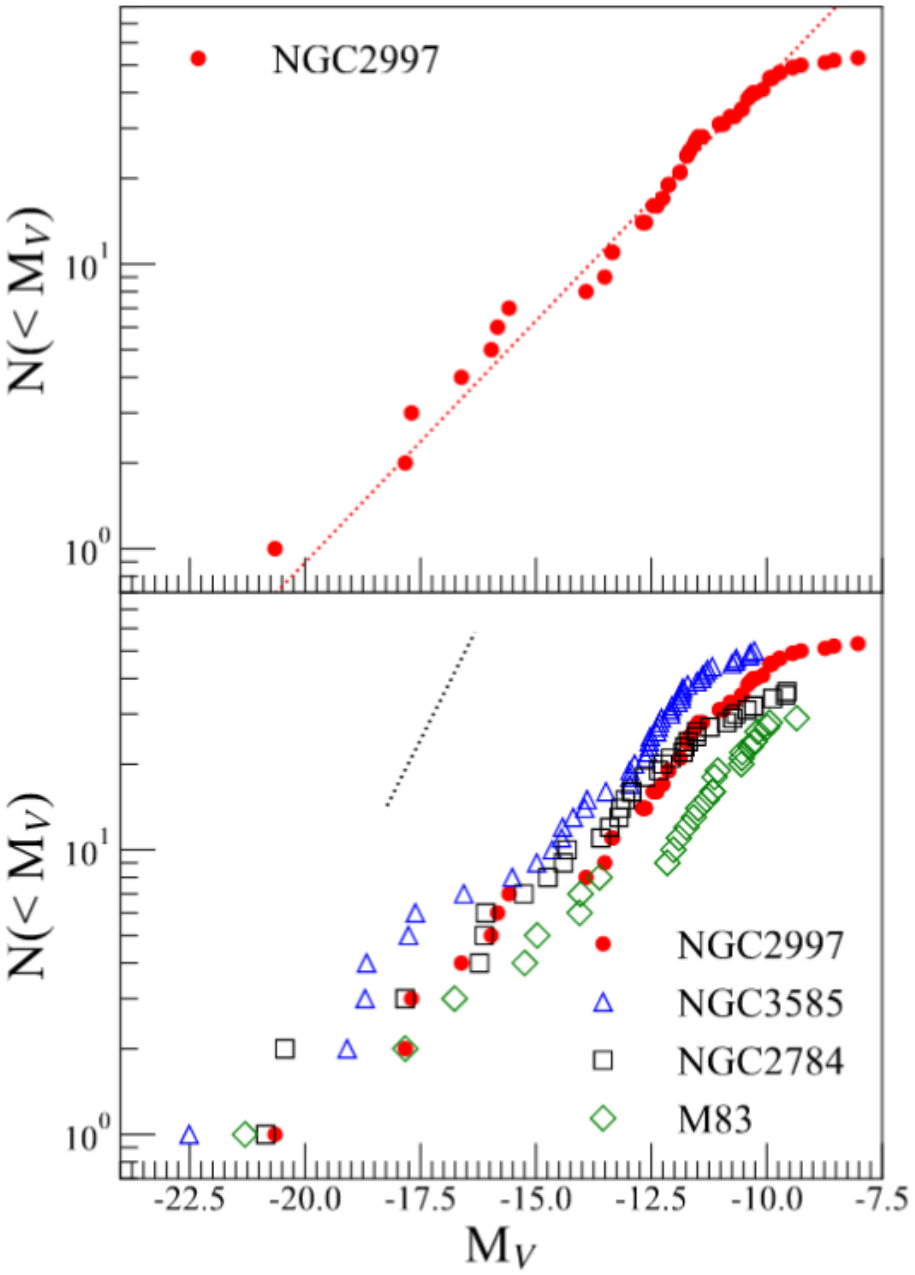
More KSP samples will lead us to understand how dwarf galaxies evolve depending on the host galaxy environment



Collection of the luminosity functions of KSP-discovered dwarf galaxies.

(Much) More to come!

The KMTNet Supernova Program in 2022-2023 will focus on the following two types of observations.

(1) Non-ToO high-cadence *BVI* monitoring of fields selected for supernova search. ← This will be similar to what we have done so far in KSP to study infant supernovae as well as other types of rapidly evolving optical transients.

(2) ToO observations of EM counterparts of gravitational-wave sources. ← We will trigger ToO observations of a sample of gravitational-wave sources expected to be discovered in 2022-2023.