Results of the Survey for the TVS-SC Supernovae Subgroup May 2019

The purpose of the survey was to find out which types of SN-related science members of the TVS Supernovae subgroup are most interested in working on with LSST, and to identify common needs for near-future collaboration. The results are divided into three sections: (1) our research interests, (2) our research readiness, and (3) opportunities for collaboration.

1 Our Research Interests.

The poll allowed respondents to indicate their general supernova-related research interests by marking boxes in a pre-defined grid of methods and physical properties for a set basic supernova types. Respondents could mark multiple boxes. The bar charts shown in Fig. 1 illustrate the responses. The poll also asked respondents to describe their general, and *LSST-specific*, research interests in a free-form text box. These responses have been collated and listed (by frequency of that item being reported), and organized into subgroups, below. Items in *italics* indicate that a respondent indicated this was an *LSST-specific* research interest. A couple of respondents used the free-form box to point out that the science they will do with the LSST depends on the eventual observing strategy cadence; e.g., whether it will be suitable to finding young SNe.

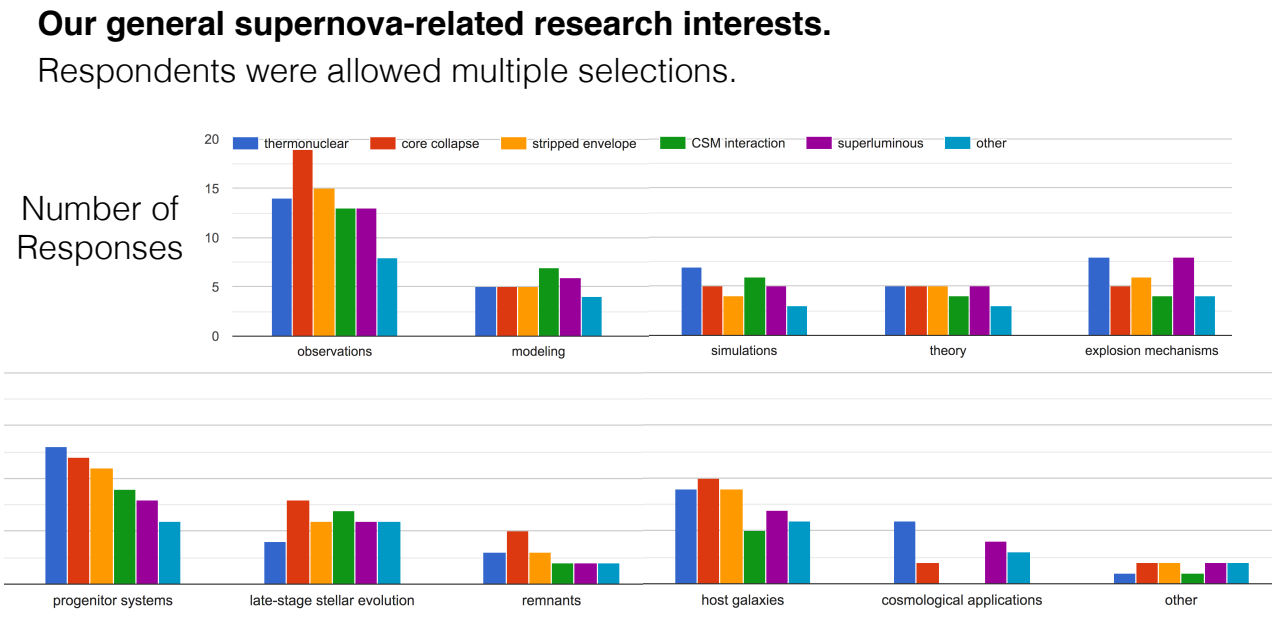

Figure 1: Bar charts illustrating respondents' general supernova-related research interests.

Supernovae (all types)
– *physical properties of their progenitors via rates, host galaxy properties*
– explosive physics, especially for rare and unusual transients
– *host galaxies properties*
– diversity, subgroups
– *spectroscopic follow-up; especially automated follow-up of LSST transients with low latency*
– *rest-frame ultraviolet observations*
– *photometric classifications via machine learning*
– *strong gravitational lensing*
– cosmology
– identifying to remove from searches for TDEs
– connections to GRBs, e.g., *possible SN/KN signatures*
– *rapid transients*
– *pre-explosion variability, eruptions*
– *rare/non-standard explosions*, e.g., pair instability, non-terminal outbursts, imposters, mergers
– *developing community alert brokers*
– *direct detections of pre-explosion progenitor stars*
– *high-redshift supernovae*

Type Ia SNe
– *progenitor systems via rates (delay times), host galaxies, and signatures of CSM interaction*
– explosion mechanisms via spectra at early/late times
– correlations between SNIa and host galaxy properites
– *cosmology with SNeIa*, developing distance fitters
– photometric classification
– modeling the selection function
– super-Chandrasekhar SNeIa

Core Collapse Supernovae
– progenitor systems via early time observations, rates
– explosion model constraints via early time observations
– mass lost histories
– as probes of star formation history via rates
– *shock interaction via early-time light curves*

Superluminous Supernovae
– explosion physics

Supernova Remnants
– connecting SNe with remnants

Multi-Messenger Events
– *MM observations*
– modeling MM observations
– theory for NS-NS mergers
– rates and host galaxy correlations

2 Research Readiness.

The poll asked respondents whether they felt "ready to do science", and the results shown in Fig. 2 are split about half and half between "somewhat" and "not really". No respondent felt that they

were "absolutely" ready, of course – but also none reported feeling that they didn't even know what "ready" would feel like. The poll provided a free-form box for respondents to state what they would most like to learn about LSST in order to feel more prepared. Most respondents would like to learn more about the observing strategy and the data products, and in particular the alert brokering system. The poll also provided a free-form box for respondents to elaborate on tools and/or precursor data sets needed in order to enable LSST science; responses were evenly divided between software tools and precursor data, but the latter is most typically required to validate the tools. All free-form responses have been collated and listed below.

Needed Information to Prepare for LSST

– observing strategy, cadence, and simulated SN yields
– data products (e.g., images, light curves, retrieval methods, latencies)
– what information alerts will contain, and how to use brokers
– demonstration of difference imaging capabilities
– for the DM stack to be validated on real data (DES/PanSTARRS)
– methods for collaboration, how to find people with common interests

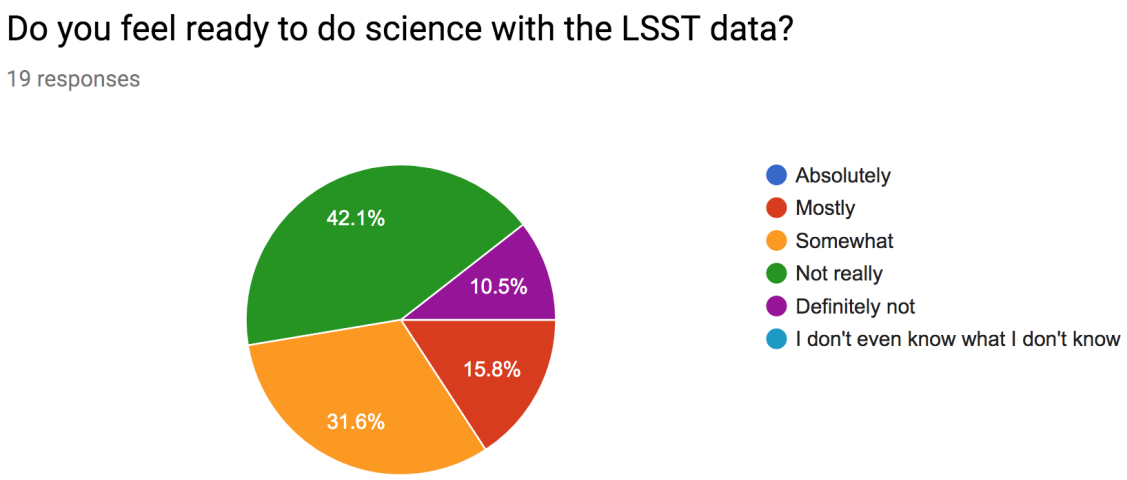

Figure 2: Pie chart of responses about feeling ready.

Needed Tools or Precursor Data Sets

– tools: machine learning (for e.g., transient classification)
– tools: brokers that can identify young CC SNe
– tools: user-friendly analysis portals
– tools: to manage the LSST catalogs of transients and static-sky source
– tools: for photometric analysis of LSST data
– tools: access to rapid-response ToO follow-up
– data: a simulated alert stream to test broker filters
– data: galaxy catalogs with LSST-like SEDs and photometric redshifts
– data: real precursor data with similar filters/cadence as LSST
– data: intrinsic SN luminosity functions from low-z surveys
– data: the LSST filter transmission curves
– data: archival imaging of the pre-SN sources

3 Opportunities for Collaboration.

The poll asked respondents whether they were interested, or participating, in any of the current TVS initiatives (i.e., mostly task forces). Over half of all respondents were interested in at least one of the initiatives, and about a quarter were already participating. (In addition, one respondent indicated they were currently participating in a TVS initiative studying the detection of GRB orphan afterglows.) This indicates that within the TVS-SN subgroup there is both an appetite and a capability for collaborative projects.

TVS Initiative	Interested	Participating
evaluating LSST observing strategies for SNe	12 (70%)	6 (67%)
light curve classification techniques for LSST time series	14 (82%)	5 (56%)
using alert brokers for science (now)	12 (70%)	5 (56%)
writing roadmap documentation for the TVS	5 (30%)	3 (33%)

The final free-form question asked respondents if they would be interested in working on new collaborative activities, and to elaborate. Of the 12 responses, two were effectively no, one was unsure, and the other 8 suggestions for scientific projects are collated below.

Potential New Collaborative Activities

– any activities related to alert brokering
– simulations of stellar populations and LSST cadence to predict transient yields
– testing photometric classification tools for LSST photometry
– building tools for host galaxy analysis
– working on neutron star mergers
– helping ensure the LSST data products, and brokers, can find strongly lensed SNe

As a final note, Fig. 3 shows that there is interest in a SN-focused session at the LSST Project and Community Workshop in August 2019. There will likely be a TVS-focused session and a series of 3 sessions on data products for time-domain astronomy that will likely satisfy this interest.

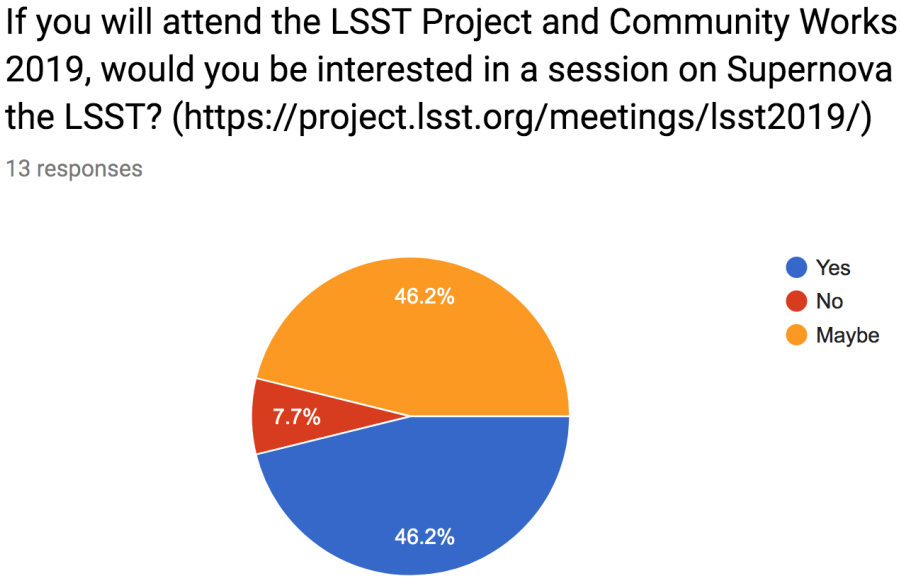

Figure 3: Pie chart of responses showing interest in a TVS SN-focused session at the LSST Project and Community Workshop in August 2019.