



STScI | SPACE TELESCOPE
SCIENCE INSTITUTE

EXPANDING THE FRONTIERS OF SPACE ASTRONOMY

Space Telescope Science Institute 2019 Spring Workshop Proposal

Gautham Narayan, on behalf of the SOC

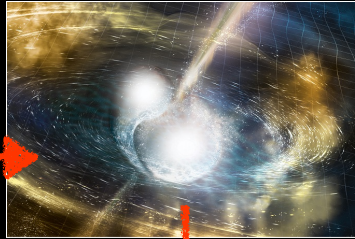
07.09.18



Enabling Multi-Messenger Astrophysics in the Big Data Era

2019 Spring Workshop Proposal

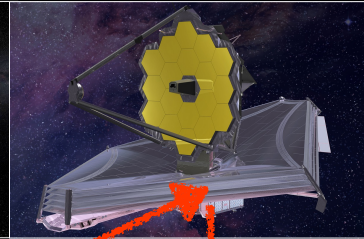
Rare Events



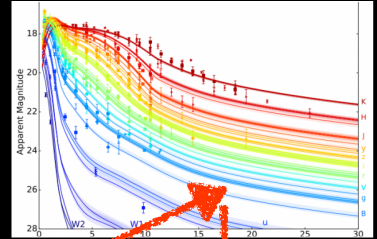
Alert Brokers



Prioritized Follow-up



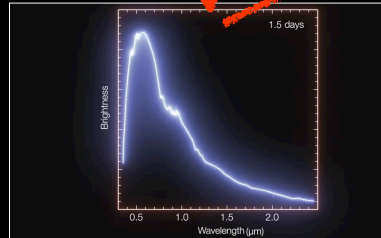
Detailed Modeling



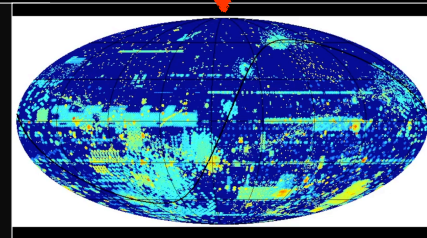
All-sky Surveys



Cloud Computing



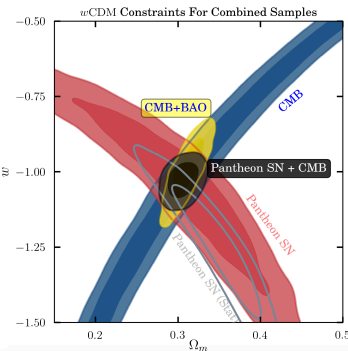
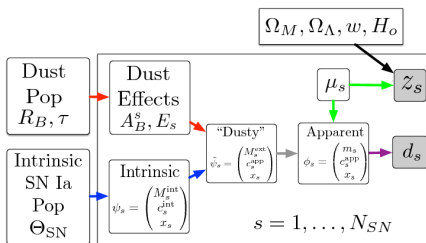
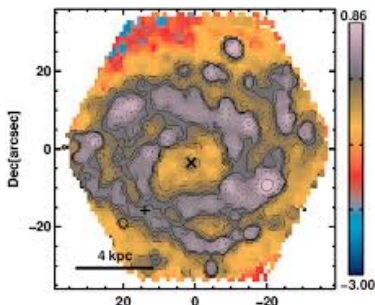
Rich Multi-Messenger Data



Active Learning



Enabling Multi-Messenger Astrophysics in the Big Data Era



Science Motivation

Stellar deaths and their afterlives are laboratories that test fundamental physics through astrophysics. These energetic events produce signals across the electromagnetic spectrum, and now in gravitational waves and neutrinos. Several ongoing or upcoming experiments (ZTF, LIGO, ATLAS, LSST, WFIRST, IceCube, SKA) will investigate these phenomena, and optimizing science return will need the community to combine, characterize, classify, filter, follow-up and analyze events from these big data streams.

Proposal

Our proposal is to conduct a two day spring workshop on “Enabling Multi-Messenger Astrophysics in the Big Data Era” immediately after the 2019 STScI Spring Symposium “The Death and Afterlives of Stars.” The symposium will define the common needs of science community, while the workshop will connect select astrophysicists with the data scientists, statisticians and observatory personnel. Together, they will identify the key infrastructure that exists, and that needs to be developed to enable multi-messenger astrophysics in the big data era, and focus on building connections between the two.

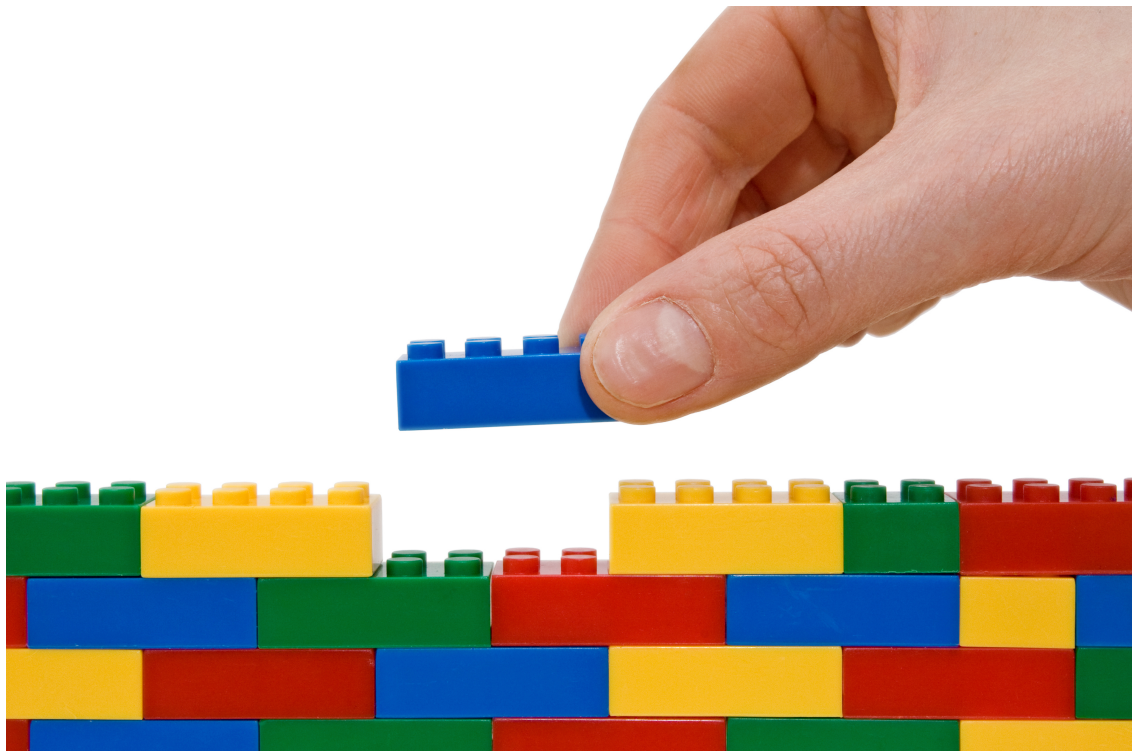


Natural Extension to “Death and Afterlives of Stars” Symposium

- How we do science is as important as what science we want to do!
- Our existing analyses do not scale
- Time on space telescopes is a critical limited resource
- **Focus on connecting infrastructure deliverables with science needs**



Natural Extension to “Death and Afterlives of Stars” Symposium



Key Science Themes Motivated by Leading Research Questions

Day 1 (4 of week)

“What infrastructure do we have?”

Morning (Connections to Symposium)

- **How** specific science cases made use of infrastructure (KN, SNIa surveys, SLSN, etc)
- What does community wish it had

Future priorities and strategies with JWST, LSST and WFIRST?

- How do we use limited follow-up resources with large photometric samples effectively
 - Emphasis on JWST and space-based resources
- How do we prioritize GW events and other rare sources of wide interest for rapid follow-up

Afternoon (Define what's needed)

Survey of current infrastructure

- What existing services and hardware will not scale?
- Lessons learnt by current wide-field surveys
- What services and infrastructure do observatories need to provide to make MMA vision a reality?

Key Science Themes Motivated by Leading Research Questions

Day 2 (5 of week)

“What infrastructure do we need?”

Morning (Define What's Being Built)

- Demos from teams building future infrastructure
 - Focus on how we use machine learning, astrostatistics, cloud computing etc
 - alert brokers
 - data labs and archives
 - TOMS and follow-up systems

Afternoon (Connect needs with resources)

- Setup three parallel hack sessions following morning groups
 - Focus on small feasible projects connecting science needs and infrastructure
 - Encourage attendance from key software developers and observatory staff

Science Organizing Committee

- ***Maria Drout** (supernovae, kilnovae, follow-up)
- ***Ryan Foley** (PS1, Foundation, YSE, WFIRST, supernovae, follow-up at scale)
- Ori Fox** (JWST/HST/Infrared Instrumentation/Observations)
- ***Renée Hložek** (LSST DESC, astrostatistics)
- ***Mansi Kasliwal** (ZTF, kilnovae, supernovae, follow-up)
- Gautham Narayan** (PS1, LSST, supernovae, ML, alert brokering)
- Armin Rest** (JWST, PS1, ATLAS, K2, supernovae, TDE, light echoes, pipelines)
- Massimo Robberto** (JWST, SCORPIO, instrumentation)
- ***Stephen Smartt** (PSST, PS1, ATLAS, supernovae, follow-up at scale)
- Arfon Smith** (DSMO)
- ***Monika Soraisam** (NOAO, novae, variable stars, big data infrastructure)
- ***Rachel Street** (LCO, LSST TVS, automated followup, microlensing)
- ***Beth Wilman** (LSST)

*external SOC members

Invited Speaker Candidates

(excluding expertise on SOC)

Existing Big Surveys - David Sand (DLT40), Chris Kochanek (ASAS-SN)

Future Surveys - Rebekah Hounsell (WFIRST), Mario Juric (LSST, ZTF)

Alert Streams - Maria Patterson (LSST, ZTF), Ken Smith (PS1, ATLAS)

Archives and Data Labs - Iva Momacheva (DSMO), Knut Olson (CSDC)

Machine Learning - Anais Möller (SNLS), Michelle Lochner (SKA)

Alert Brokers - Francisco Forster (ALERcE), David Young (LASSAIR, PSST)

Astrostatistics - Jacob VanderPlas (astroML), Kaisey Mandel (RAISIN), Ilya Mandel (Monash), Ben Farr (Flatiron/Stonybrook)

Active Learning - Emilie Ishida (LSST), Joshua Bloom (ZTF)

Organizing Principles

Workshop Goal

- The symposium will identify the needs of the community
- The workshop will address those needs by connecting scientists to resources they may not be familiar with, and highlight what needs are unaddressed
- Workshop attendees will be heavily skewed towards members of the community that are builders (hardware and software)

Diversity

- We will have a SOC with a 50/50 male/female representation
- We will have an invited speaker list with a 50/50 male/female representation
- We will have >30% speakers selected through contributed talks, and will ensure a diverse selection
- We will ensure a balanced distribution of students, postdocs, and faculty, and we will **actively** seek minority participation in the workshop

Workshop Structure

- We will structure the agenda to foster working on small projects (short talks 10+5, longer demos, focus on building
- SOC will organize an SDAS like reception to engage participants with others at STScI
- SOC members will organize and lead dinner parties at local restaurants



The Deaths and Afterlives of Stars
2019 Spring Symposium Proposal



**Enabling Multi-Messenger
Astrophysics in the Big Data Era
2019 Spring Workshop Proposal**