

# Time Domain Astrophysics: Stars and Explosions

**scialog2015**<sup>®</sup>

The First Annual Scialog Conference  
October 22-25, 2015 at Biosphere 2

## Conference Objectives

Engage in dialog with the goal of accelerating high-risk/high-reward research.

Identify and analyze bottlenecks in advancing time domain astrophysics and develop approaches for breakthroughs.

Build a creative, better-networked community that is more likely to produce breakthroughs.

Form teams to write proposals to seed novel projects based on highly innovative ideas that emerge at the conference.

## Conference Process

Brainstorming is welcome; don't be afraid to say what comes to mind.

Consider the possibility of unorthodox or unusual ideas without immediately dismissing them.

Discuss, build upon and even constructively criticize each other's ideas – in a spirit of cooperative give and take.

Make comments concise to avoid monopolizing the dialog.

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# Scialog: Time Domain Astrophysics

## From the President

Welcome to the first **Scialog Conference on Time Domain Astrophysics**.

As befits a topic dealing with change and variability, we ask you to shift your thinking somewhat for the next few days and accept the unique approach to scientific dialog that is a Scialog hallmark. It requires that you actively participate in the discussions by fearlessly brainstorming and saying what comes to mind, even if your thoughts on the topic under discussion may be considered unorthodox or highly speculative. The Scialog methodology also requires that you consider the novel ideas of others without summarily rejecting them, although constructive criticism is always appropriate. In this way we are hoping you will discuss and build upon innovative ideas that lead to intriguing, collaborative research proposals RCSA can fund soon after the conference has concluded.

Those of us who work at RCSA feel the Foundation enjoys a special kinship with the field of Time Domain Astrophysics. Research Corporation was a very early supporter of radio astronomy through the pioneering—and, at the time, seemingly unorthodox—work of Grote Reber. And, through the visionary efforts of former RCSA President John P. Schaefer, it was a key founding entity in the creation of the Large Synoptic Survey Telescope. RCSA has also been a key player in the development and support of the innovative Large Binocular Telescope atop Mt. Graham in Southeastern Arizona.

These superb instruments, by their inherent complexity and expense, promote collaboration and cross-discipline interactions, two factors RCSA tirelessly encourages across all of the physical sciences. It is our belief that communities of scientific innovators are much more likely than isolated individuals to come up with solutions to the many globally significant challenges facing us today. And thus it is our sincere hope that this Scialog enhances the sense of community, collaboration and innovation among time domain astrophysicists and others in the physical sciences.

Finally, I would like to thank your colleague, Dr. Lars Bildsten, a member of the RCSA Board of Directors as well as the Director of the Kavli Institute for Theoretical Physics and a Professor of Physics at the University of California, Santa Barbara. Lars suggested this topic as a natural focus for Scialog, and he also assisted Scialog Program Director Richard Wiener in developing the list of invitees and the program.

We hope you find the competition for Scialog funding to be a stimulating, team-building process; but perhaps more importantly, we hope you come away with a deeper, more meaningful understanding of the issues and potential challenges at the bleeding edge of time domain astrophysics. Have fun!

**Robert N. Shelton**

President and CEO

Research Corporation for Science Advancement

## From the Program Director

This year we are holding the first of two conferences for *Scialog: Time Domain Astrophysics: Stars and Explosions*. This initiative continues Research Corporation's tradition of highly interactive Scialog meetings on scientific topics of great importance, with the goal of identifying bottlenecks and finding innovative ideas for potential breakthroughs. The emphasis of Scialog meetings is on dialog, networking and building new collaborations to pursue novel high-risk discovery research.

Research Corporation chose to focus this Scialog on time domain astrophysics because we believe this critical area of science is on the cusp of major breakthroughs. Just as firmly, we believe these breakthroughs can be accelerated by astronomers, astrophysicists and data scientists working collaboratively on novel high-risk projects, particularly with theorists and observers combining efforts. The goal of *Scialog: Time Domain Astrophysics: Stars and Explosions* is to catalyze new collaborations, based on blue-sky ideas, among Scialog Fellows, who constitute a highly select group of exemplary early career U.S. scientists.

We have two outstanding keynote speakers:

- **Lars Bildsten**, KITP, University of California, Santa Barbara
- **Shrinivas Kulkarni**, California Institute of Technology

We also have outstanding discussion facilitators including **Lars** and **Shri**; **Todd Boroson**, Las Cumbres Observatory; **Suzanne Hawley**, University of Washington; **Christopher Kochanek**, Ohio State University; **David Silva**, National Optical Astronomy Observatory; **Keivan Stassun**, Vanderbilt University; **Alexander Szalay**, Johns Hopkins University; **Craig Wheeler**, University of Texas at Austin; and **Beth Willman**, LSST & University of Arizona.

Scialog conferences focus on dialog and team building with the goal of creating novel strategies and collaborative approaches. An important feature of Scialog meetings is the opportunity for Scialog Fellows to form teams and write proposals to pursue particularly creative ideas that emerge through the dialog. We hope this competition is exciting, but regardless of which proposals are funded, the purpose is to catalyze a deeper and more meaningful exchange of ideas than ordinarily occurs at scientific conferences. Our goal is for this process to facilitate participants gaining new insights and connections that significantly advance efforts to understand stars, explosions and related aspects of time domain astrophysics.

The Scialog Advisory Committee – **Lars, Todd, Suzanne** and **Shri** – deserve big thanks for helping to organize this meeting.

We hope each participant finds the Scialog experience of great value. Please do not hesitate to provide feedback on how to make the conference better. We are here to listen and to make this a great experience for you!

**Richard Wiener**

Program Director

Research Corporation for Science Advancement

# Scialog: Time Domain Astrophysics

## Conference Agenda Biosphere 2 October 22-25, 2015

### Thursday, October 22

1:00 pm	<b>Registration Opens</b>	Visitor Center
1:00 - 3:00 pm	<b>Lunch</b>	Café Patio
3:30 - 4:30 pm	<b>Optional Tour of Biosphere 2</b>	Visitor Center
5:00 - 6:30 pm	<b>Poster Session and Reception</b>	Biosphere 2 Plaza
6:30 - 7:30 pm	<b>Dinner</b>	Biosphere 2
7:30 - 7:40 pm	<b>Welcome</b> Elizabeth McCormack, <i>Member, RCSA Board of Directors</i>	Biosphere 2
7:40 - 8:00 pm	<b>Conference Overview, Hoped for Outcomes &amp; Guidelines for Collaborative Proposals</b> Richard Wiener, <i>Program Director, RCSA</i>	Biosphere 2
8:00 - 9:00 pm	<b>Introductions</b>	Biosphere 2
9:00 - 9:30 pm	<b>Meeting for Discussion Facilitators</b>	Biosphere 2
9:00 - 10:00 pm	<b>TDA Café</b> Wine, Beer, Conversations, etc.	Café Patio

### Friday, October 23

7:00 - 8:00 am	<b>Breakfast</b>	Café Patio
8:00 - 9:30 am	<b>Keynote Presentations</b> Lars Bildsten and Shri Kulkarni	Sahara Room
9:30 - 10:00 am	<b>Morning Break &amp; Conference Photo</b>	
10:00 - 10:15 am	<b>Breakout Sessions Description &amp; Goals</b>	Sahara Room
10:15 - 11:15 am	<b>Breakout Session I</b>	Sahara Room
11:15 - 11:45 am	<b>Report Out</b>	Sahara Room
11:45 am - 12:15 pm	<b>Mini Breakout Session I</b>	Multiple Rooms
12:15 - 2:00 pm	<b>Lunch &amp; Free Interaction Time</b>	Café Patio
2:00 - 3:00 pm	<b>Breakout Session II</b>	Sahara Room
3:00 - 3:30 pm	<b>Report Out</b>	Sahara Room
3:30 - 4:00 pm	<b>Mini Breakout Session II</b>	Multiple Rooms
4:00 - 4:30 pm	<b>Afternoon Break</b>	
4:30 - 6:30 pm	<b>Poster Session and Reception</b>	Biosphere 2 Plaza
6:30 - 7:30 pm	<b>Dinner</b>	Biosphere 2
7:30 - 10:00 pm	<b>TDA Café</b> Wine, Beer, Conversations, etc.	Café Patio

**Saturday, October 24**

6:15 - 7:15 am	<b>Optional Nature Hike/Run</b>	B2 Trails
6:30 - 8:00 am	<b>Breakfast</b>	Café Patio
8:00 - 9:00 am	<b>Breakout Session III</b>	Sahara Room
9:00 - 9:30 am	<b>Report Out</b>	Sahara Room
9:30 - 10:00 am	<b>Mini Breakout Session III</b>	Multiple Rooms
10:00 - 10:30 am	<b>Morning Break</b>	
10:30 - 11:30 am	<b>Breakout Session IV</b>	Sahara Room
11:30 am - 12:00 pm	<b>Report Out</b>	Sahara Room
12:00 - 12:30 pm	<b>Mini Breakout Session IV</b>	Multiple Rooms
12:30 - 1:30 pm	<b>Lunch</b>	Café Patio
1:30 - 6:00 pm	<b>Team Formation, Informal Discussion, &amp; Proposal Writing</b> Proposals due 8:00 am Sunday morning.	Multiple Rooms
3:30 - 4:30 pm	<b>Optional Tour of Biosphere 2</b>	Visitor Center
6:00 - 6:30 pm	<b>Reception</b>	Biosphere 2 Plaza
6:30 - 7:30 pm	<b>Dinner</b>	Biosphere 2
7:30 - 10:00 pm	<b>TDA Café and Proposal Writing</b> Wine, Beer, Conversations, etc.	Café Patio

**Sunday, October 25**

7:00 - 8:00 am	<b>Breakfast</b>	Café Patio
8:00 - 8:30 am	<b>Assessment Survey</b>	Sahara Room
8:30 - 10:30 am	<b>Presentations of Proposal Ideas</b>	Sahara Room
10:30 - 11:00 am	<b>Conference Wrap-up</b>	Sahara Room
11:00 - 12:00 pm	<b>Lunch</b> Available to go	Café Patio

## Keynote Speaker

## Science Frontiers in Stellar Variability and Explosions



### Lars Bildsten

*Director, Kavli Institute for Theoretical Physics,  
University of California, Santa Barbara*

**Abstract:** I will highlight recent progress in stellar variability (mostly astero-seismology from Kepler), where highly accurate data combined with theoretical work has led to fundamental new measurements of the rotation, magnetic fields and burning states deep within red giants. I will then provide a brief overview of stellar explosions, noting the diversity of energy sources at play and hopefully setting the stage for the discussions that will occur over the next few days.

**Bio:** Lars Bildsten is director of the Kavli Institute for Theoretical Physics, and a member of the physics department at University of California, Santa Barbara. He is also a foreign associate of the Cosmology and Gravity Program of the Canadian Institute for Advanced Research. He received his Ph.D. in theoretical physics from Cornell University in 1991, where he held a Fannie and John Hertz Graduate Fellowship. Bildsten has done award-winning fundamental work on stellar structure, including nuclear burning on neutron stars, the role of neutron stars as gravity wave sources, and the theory of lithium depletion. He has served on many recent NRC panels, including the Committee on Astronomy and Astrophysics from 2001 to 2005, and the Panel to Review the Science Requirements for the Terrestrial Planet Finder and the Committee on Review of Progress in Astronomy and Astrophysics toward the Decadal Vision in 2005. He was a member of the NSF's Mathematical and Physical Science Advisory Committee from 2004 to 2007. From 2008 to 2010, he served on the Astro2010: The Astronomy and Astrophysics Decadal Survey Committee.

**Keynote Speaker**

## Time Domain Astronomy v.2

**Shrinivas Kulkarni**

*FRS, Professor of Astrophysics and Planetary Science,  
California Institute of Technology*



**Abstract:** We are in the midst of the Time Domain Astronomy (TDA) revolution and the astronomical returns are – simply put – astronomical. There is a visible growth in the number of practitioners. Just as the Cambrian explosion marked an exponential growth in life-forms we now have an explosion in the ways by which astronomers are practicing TDA. I will summarize this explosion and end topics for discussions such as: what are the common needs? How does one optimize different surveys? Can different surveys be combined to reduce costs or to increase returns?

**Bio:** Shrinivas Kulkarni holds a McArthur Professorship in Astronomy and Planetary Science at Caltech, where he is also director of optical observatories, including Palomar and Keck. He has worked on millisecond pulsars, old neutron stars, young neutron stars, brown dwarfs, soft gamma-ray repeaters, supernova remnants, gamma-ray bursts, as well as new types of optical transients and instrumentation. His current focus is the Palomar Transient Factory, an innovative two-telescope approach to a systematic study of the transient sky. Ongoing instrumentation projects: Robo-AO the first robotic AO (Rayleigh scattering) system well suited for 2-m class telescopes; the SED Machine which aims to “leave no transient unclassified.” Also, in development phase: Zwicky Transient Facility (47 square degrees FOV on the Oschin 1.2m telescope) aimed at an exploration of the transient sky (brighter than 21 mag; first light in 2017); ULTRASAT, a Weizmann-Caltech project to do the same but in the UV (currently in study phase).

# Scialog: Time Domain Astrophysics

## Proposal Guidelines

### Collaborative Awards

1. Awards are intended to provide seed funding for teams of two or three Scialog Fellows formed at this conference.
2. Two-page proposals should describe the proposed project and the role of each team member. No budget is necessary. A third page may be used for references.
3. Awards will be in the amount of \$100K direct funding and divided between team members according to the team's preference.
4. No Scialog Fellow can be a member of more than two teams. If a Scialog Fellow is a member of two teams, other members of the two teams must be different. No team can submit more than one proposal.
5. Teams are encouraged to:
  - a) Include at least one theorist or computational scientist and one observer.
  - b) Not include members who have previously collaborated with one another.
  - c) Base their proposal on an emerging question in time domain astrophysics where a collaborative approach is likely to have the most impact.
6. Proposals must be submitted electronically by Sunday morning at 8:00 am to RCSA Program Directors Richard Wiener ([rwiener@rescorp.org](mailto:rwiener@rescorp.org)) and Silvia Ronco ([sronco@rescorp.org](mailto:sronco@rescorp.org)).
7. Awards will be announced in about two months.

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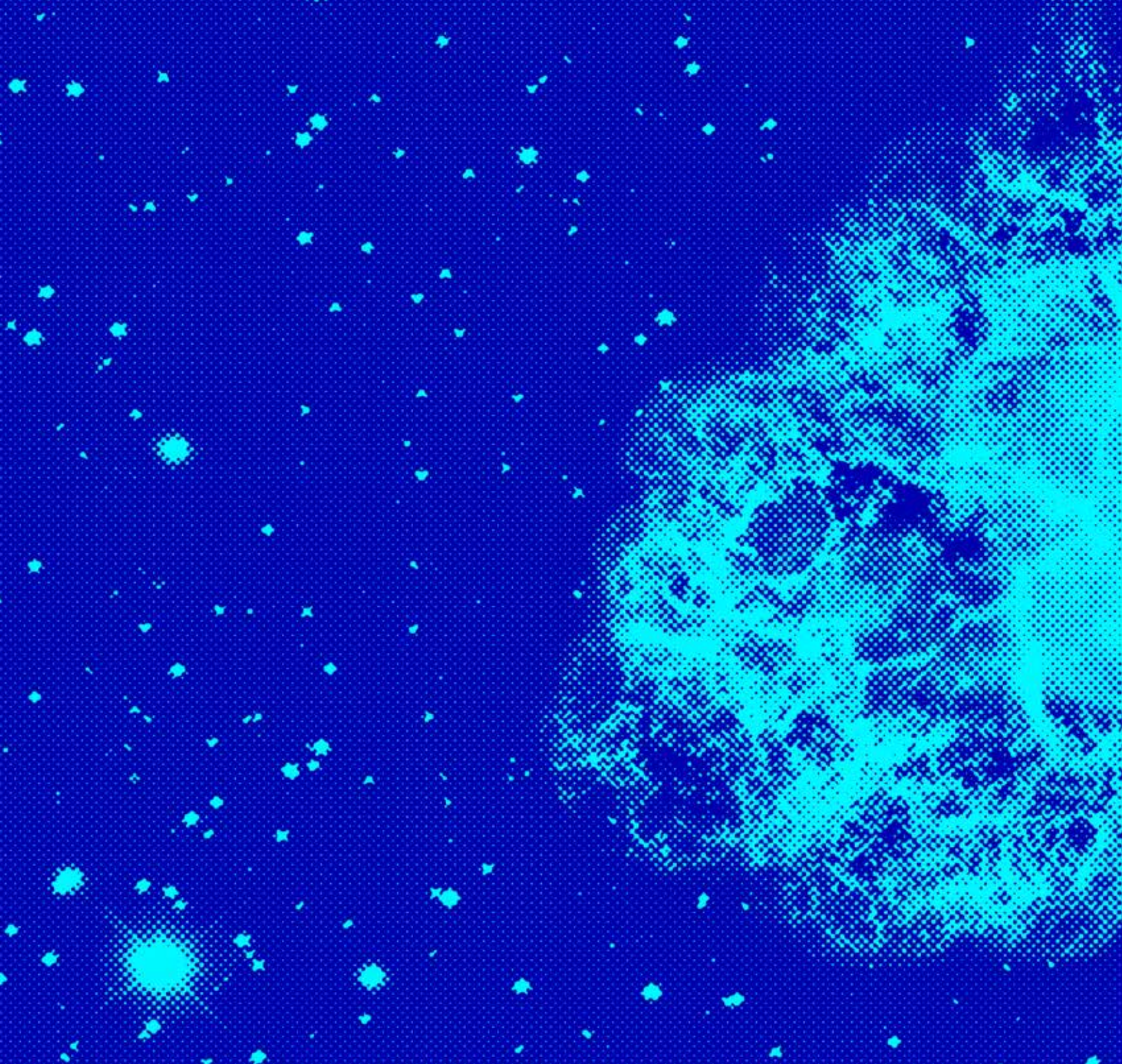
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