A Message from SFI Vice President for Science

Hello and welcome to “almost” spring. Of course, here in Northern New Mexico we’re still waiting for winter to begin, alas....

As we mentioned last time, 2018 promises to be our busiest year yet in terms of science events and visitors. Under Looking Ahead there are seven (!) very diverse Working Groups scheduled at SFI in March and April. “The Complexity of the Patenting System: Information, Uncertainty and Novelty,” March 12-14, is a joint effort with ACTioN and is co-organized by José Lobo and Deborah Strumsky (ASU-SFI Center). “Co-Evolution of Behaviors and Institutions,” March 15-17, is co-organized by Sam Bowles (Resident Faculty), Herbert Gintis, Rob Boyd and Larry Blume (External Faculty), and Peyton Young (LSE). “Extending the Reach of Info-Metrics to Dynamic and Non-Hierarchical Complex Systems,” March 15-16, is co-organized by Amos Golan and John Harte (External Faculty), and Andy Rominger (Omidyar Fellow). “Limits to Inference in Networks and Noisy Data,” April 2-6, is organized by Cris Moore (Resident Faculty). “Social Reactors: The Fragility of Growth in the Past,” April 5-6, is co-organized by José Lobo (ASU-SFI Center) and Scott Ortman (External Faculty). “Modeling Hate Crimes,” April 9-10, is organized by Mirta Galesic (Resident Faculty). And last but not least, “Oxygen and the Rise of Animals,” April 25-27, is co-organized by Doug Erwin (External Faculty) and Noah Planavsky (Yale).

In addition to all of the Working Groups, there are three major Workshops happening. The third “Postdocs in Complexity” conference, March 27-30, co-organized by David Krakauer (President and Resident Faculty) and Hilary Skolnik (Manager, Postdoc Program), brings together James S. McDonnell Foundation (JSMF) postdocs and Santa Fe Institute (SFI) postdocs. The prior conferences have been extremely successful at developing a strong network of early career complexity scientists, facilitating new collaborative research, establishing best practices for complex systems science research, and introducing JSMF postdocs to SFI. Emphasis for this conference will be on developing collaborations formed in 2017 and promoting collaborations among new participants. We expect these twice yearly meetings to continue into the future.

The other two Workshops are “From Judgment to Impact,” April 3-4, co-organized by David Krakauer and Manfred Laubichler (External Faculty, ASU-SFI Center), and “Integrating Different Perspectives on Social Learning,” April 16-19, co-organized by Mirta Galesic (Resident Faculty), Daniel Barkoczi (Max Planck), and Giuseppe Carbone and Ilaria Giannoccaro (Politecnico di Bari). A reminder: resident and visiting researchers are always welcome to sit in on workshops, but need to ask organizers before sitting in on working groups.

Under Funding and People we highlight External Professor Michelle Girvan (University of Maryland, College Park). Michelle is an example of our robust intellectual pipeline: she began her association with SFI as an undergraduate student, became a postdoctoral fellow and is now an active member of the external faculty.

Jennifer Dunne
Vice President for Science

Updates and trends

Cautious optimism emerged last month after Congress reached agreement on a major two-year deal to raise budget caps that have constrained federal spending since 2011. It is anticipated this will translate into major increases for federal science agencies and programs. In the meantime though the government remains operating under a continuing resolution through March 22.

After a historically slow start the administration has increased the pace of nominations for scientific leadership positions in federal agencies, though many top positions remain vacant. The position of director of the White House Office of Science and Technology Policy, who coordinates scientific programs across government and traditionally also serves as the president’s science advisor, remains vacant. Nominations for leaders for the Department of Energy Office of Science and the U.S. Geological Survey are pending. Among nominations to date are leaders for NASA, the National Oceanic and Atmospheric Administration, the National Institute of Standards and Technology and...
the National Nuclear Security Administration. Without confirmed leaders at the top, science agencies have found it difficult if not impossible to make decisions about new strategies and directions.

Funding and people

RECENT PROPOSALS

Mirta Galesic and Henrik Olson, NSF MMS, SciFriends: A methodological tool for studying how social circles influence beliefs about scientific issues. $388,668 over two years.

Chris Kempes, SETI Institute / NASA Ames, Frontier Development Lab (FDL) - Biosignature Detection. $20,548 for one year.

Cris Moore, Stanford University / Simons Foundation, Algorithms and Statistical Mechanics. $400,000 over four years.

David Wolpert, ARO, Supplement: Event-Driven Game Theory for Predicting Dynamics of Social Systems. $175,000 for one year.

RECENT AWARDS

Mirta Galesic (with Nina Federoff and Dan Stein) USDA/ NIFA Formation of beliefs about scientific issues: the case of GM foods. $499,693 over two years.

EXTERNAL FACULTY PROFILE

Michelle Girvan, Associate Professor, Department of Physics, University of Maryland.

1) How did you first get involved with SFI?

I first got involved with SFI when I was a grad student in the physics department at Cornell. At the time, Mark Newman, who was then a member of SFI’s resident faculty, was spending a semester at Cornell as a visiting professor. I was fortunate to start a couple of research projects with Mark which led to him inviting me to spend the summer at SFI. From that point on, I was hooked. A summer turned into a year, which led to a postdoc at SFI, and finally a position on the external faculty.

2) What does SFI mean to you?

To me, SFI means intellectual freedom — freedom from disciplinary boundaries and conventions. It’s a place for taking risks — special kinds of risks — informed, creative, and ambitious.

3) How have you been involved with SFI recently? What are you working on now?

In July 2017, I had the pleasure of directing a NYC-based short course on “Networks and Big Data” that was hosted by SFI as part of its Applied Complexity Network (ACTioN). We had a number of great speakers who talked about real-world applications of cutting-edge network and data science. I think that the participants — from various corners of industry, government, and academia — left with new appreciation for and excitement about both the wide-reaching utility of network science and SFI’s role in untangling complex systems.

4) What are you working on now?

Experimental evidence suggests that, in order to maximize performance, biological networks often operate near the brink of failure. Because of the connections between such “tipping points” and the critical points of second order phase transitions, the methods of statistical and nonlinear physics are useful for studying these systems. My research in this area explores phase transitions and critical dynamics in both networks of genes and networks of neurons. Modeling phase transitions in gene regulatory networks has led us to propose a general mechanism underlying some cancers. Modeling phase transitions in neuronal networks has allowed us to identify features of the brain’s wiring that are key for optimal information processing. For both networks of genes and networks of neurons, studying how evolution shapes the path to criticality gives us insights into robustness and fragility in these systems.

OPPORTUNITIES

FEDERAL AGENCIES

NSF Dear Colleague Letter: Signals in the Soil (SitS) (DCL 18-047)
Deadline: April 13, 2018
(Research Concept Outline)

The Directorate for Engineering (ENG) in collaboration with Directorates for Biological Sciences (BIO), Computer and Information Science and Engineering (CISE), and Geosciences (GEO), aims to encourage convergent research that transforms existing capabilities in understanding dynamic near-surface processes through advances in sensor systems and dynamic models. The goal of this DCL is to encourage submission of Early-Concept Grants for Exploratory Research (EAGER) proposals for early-stage, high-risk, high-reward research on technologies, models, and methods to better understand dynamic soil processes, including interactions of the macro- and microbiomes with soil nutrients, the rhizosphere, and various abiotic and biotic processes within the soil. In addition, for proposals that include topics relevant to both this DCL and the NSF “Rules of Life” Big Idea, submissions of Research Advanced by Interdisciplinary Science and Engineering (RAISE) proposals are encouraged. Researchers who are interested
in submitting a SitS EAGER or RAISE proposal must first submit a SitS Research Concept Outline, as described in the DCL. Selected submitters of these Outlines will be invited to submit full EAGER or RAISE proposals for funding consideration.

**NSF Dear Colleague Letter: Stimulating Research Related to Navigating the New Arctic (NNA) (NSF 18-048)**

This Dear Colleague Letter (DCL) invites proposals that will advance NNA research through convergent approaches to emerging scientific, engineering, societal, and education challenges, and builds upon the NNA awards resulting from the FY 2017 DCL on Growing Convergence Research at NSF. A systems-based approach is strongly encouraged, including research that both contributes to, and leverages, large data sets from enhanced observational technology and networks. Knowledge co-production with local and indigenous communities, advancing public participation in research, and international partnerships are also strongly encouraged as possible means to achieve NNA objectives. Deadlines will vary in accordance with the specific program and/or funding vehicle to which proposals are submitted. See Dear Colleague Letter for examples of topic areas.

**NSF Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA)**

**Deadline Window: May 7-14, 2018**

The BIGDATA program seeks novel approaches in computer science, statistics, computational science, and mathematics leading towards the further development of the interdisciplinary field of data science. The program also seeks innovative applications in domain science, including social and behavioral sciences, education, physical sciences, and engineering, where data science and the availability of big data are creating new opportunities for research and insights not previously possible.

The solicitation invites two categories of proposals:

- **Foundations (BIGDATA: F):** those developing or studying fundamental theories, techniques, methodologies, and technologies of broad applicability to big data problems, motivated by specific data challenges and requirements; and

- **Innovative Applications (BIGDATA: IA):** those engaged in translational activities that employ new big data techniques, methodologies, and technologies to address and solve problems in specific application domains. Projects in this category must be collaborative, involving researchers from domain disciplines and one or more methodological disciplines, e.g., computer science, statistics, mathematics, simulation and modeling, etc.

Proposals are expected to be well motivated by specific big data problems in one or more science and engineering research domains. All proposals are expected to clearly articulate the big data aspect(s) that motivate the research. Innovative Applications proposals must provide clear examples of the impacts of the big data techniques, technologies and methodologies on applications in one or more domains.

**Award Information:** Projects will typically receive NSF funding in the range of $200,000 to a maximum of $500,000 per year, for 3 to 4 years of support. The minimum award size will be $600,000 of total NSF funding, reflecting the minimum expected level of effort for BIGDATA projects. The maximum award size will be $2,000,000 of total NSF funding. BIGDATA projects are expected to be multidisciplinary in nature and include significant student involvement.

**NASA Research Opportunities in Space and Earth Science (ROSES) 2018**

**Deadlines: various (Notices of intent to propose and Step-1 Proposals are due mid-March 2018, through January 2019. Full (Step-2) Proposals are due: May 2018 through April 2019.)**

ROSES is an omnibus solicitation, with many individual program elements, each with its own due dates and topics. Tables 2 and 3 of this NRA, provide proposal due dates and hypertext links to descriptions of the solicited program elements in the Appendices of this NRA. All together these program elements cover the wide range of basic and applied supporting research and technology in space and Earth sciences supported by SMD. The topics and types of proposals solicited include flight investigations, using suborbital-class platforms (including aircraft, balloons, sounding rockets, CubeSats, commercial suborbital reusable launch vehicles, and small International Space Station payloads), and all kinds of ground-based supporting research and technology investigations that seek to understand naturally occurring space and Earth phenomena, human-induced changes in the Earth system, and Earth and space science-related technologies and to support the national goals for further robotic and human exploration of space. These ground-based investigations include, but are not limited to: theory, modeling, and analysis of SMD science data, (together with data from SMD’s international and/or interagency partners) development of concepts, techniques and advanced technologies suitable for future SMD space missions; development of methods for laboratory analysis of both extraterrestrial samples returned by spacecraft and terrestrial samples that support or otherwise help verify observations from missions; determination of atomic and composition parameters needed to analyze space data, as well as returned samples from the Earth or space; Earth surface observations and field campaigns that support SMD science missions; development of integrated Earth system models; development of systems for applying Earth science research data to societal needs; and development of applied information systems applicable to SMD objectives and data.
Award Information: Awards range from under $100K per year for focused, limited efforts (e.g., data analysis) to more than $1M per year for extensive activities (e.g., development of hardware for science experiments and/or flight).

Looking Ahead

EVENTS

WSWG, Colloquia, Seminars, and more...

VISITORS: March - April, 2018


Barkoczi, Daniel, 4/20-29/2018, Linköping University. SFI host: Mirta Galesic

Blumsack, Seth, 3/12-16/2018, Pennsylvania State University. SFI host: Jennifer Dunne


Crabtree, Stefani, 3/7-21/2018, Washington State University. SFI host: Jennifer Dunne


Dolan, Liam, 3/4-11/2018, University of Oxford. SFI host: Laura Fortunato

Erwin, Douglas, 3/31/2018 – 4/2/2018, National Museum of Natural History of the Smithsonian Institution; Santa Fe Institute External Professor. SFI host: Jennifer Dunne

Fisher, David, 3/6-11/2018, Emory University. SFI host: Elizabeth Hobson


Golan, Amos, 3/11-17/2018, American University; Santa Fe Institute External Professor. SFI host: Jennifer Dunne

Gonzales, Laurence, 3/11-17/2018, SFI Miller Scholar. SFI host: Jennifer Dunne

Hamid, Nafees, 3/18/2018 – 4/13/2018, University College London. SFI host: Mirta Galesic

Hammond, Ross, 3/9-15/2018, Brookings Institution; Santa Fe Institute External Professor. SFI host: Jennifer Dunne

Hanson, Dieta, 3/11-17/2018, McGill University. SFI host: Jennifer Dunne

Hochberg, Michael, 3/25/2018 – 4/2/2018, University of Montpellier; Santa Fe Institute External Professor. SFI host: Jennifer Dunne

Jones, James, 4/22-28/2018, Stanford University. SFI host: Michael Price

Kahn, Jennifer, 3/10-16/2018, College of William & Mary. SFI host: Jennifer Dunne

Kao, Albert, 3/25/2018 – 4/10/2015, Harvard University. SFI host: Jessica Flack

Krapivsky, Paul, 4/10-18/2018, Boston University. SFI host: Sid Redner


Mønster, Dan, 4/1/2018 – 7/31/2018, Aarhus University. SFI host: Jennifer Dunne

Newberry, Mitchell, 3/13-19/2018, University of Pennsylvania. SFI host: Jennifer Dunne

Parker, Andrew, 4/1-3/2018, RAND Center for Decision Making. SFI host: Mirta Galesic

Prohaska, Sonja, 3/15/2018 – 4/7/2018, University of Leipzig. SFI host: Jennifer Dunne

Retzlaff, Nancy, 3/15/2018 – 4/7/2018, University of Leipzig. SFI host: Jennifer Dunne

Stadler, Peter, 3/15/2018 – 4/7/2018, University of Leipzig; Santa Fe Institute External Professor. SFI host: Jennifer Dunne

Vardavas, Raffaele, 4/1-3/2018, RAND Center for Decision Making. SFI host: Mirta Galesic

Ver Steeg, Greg, 4/8-14/2018, University of Southern California. SFI host: Cris Moore

Webber, Elke, 3/18-21/2018, Princeton University. SFI host: Mirta Galesic

Werfel, Justin, 3/20-22/2018, Harvard University. SFI host: Melanie Moses

Wood, Spencer, 3/7-20/2018, Stanford University. SFI host: Jennifer Dunne