Simons Institute
for the Theory of Computing

Bears 2013

February 14, 2013

Simons Institute for the Theory of Computing

- Funded by the Simons Foundation

- Selected in competition among 18 leading research universities including MIT/Harvard, Princeton, Stanford, Chicago

- Our trump cards in the competition: strong department(s), outreach to diverse fields, ties with industry, enthusiastic faculty, strong campus support, Calvin Hall

Berkeley's Vision for the Simons Institute

- Create the world's leading center for research in the theory of computing;

- Strengthen the field's core and foundations;

- Set the agenda for a theory of computing that extends far beyond the current reach of the field.

The Computational Lens

- Many phenomena in the physical, biological, engineering and social sciences, and in the world of commerce, can be viewed as essentially computational in nature, and can be studied with the methods of theoretical computer science.

- Conferences at Berkeley in 2002 and 2011 highlighted the growing impact of *the computational lens* on areas such as quantum information science, statistical physics, social networks, economics and game theory, molecular biology, evolutionary biology and machine learning.

- The computational lens will be a recurrent theme in the programs of the Simons Institute

The Computational Lens: Examples

- Will the effort to understand the limits of quantum computing lead to a major revision of quantum mechanics?

- Beyond micro- and macro-, will the understanding of the economic processes underlying information networks require the development of a new *nano-economics?*

- Biological phenomena from evolution down to the living cell are inherently computational in nature and cannot be fully understood without computational models;

- In statistical physics, phase transitions coincide precisely with the onset of computational intractability.

Planned Programs

- **Spring 2013**

    Symposium on Visions of the Theory of Computing

    Exploratory meeting on Quantum Hamiltonian Complexity

- **Fall 2013**

    Real Analysis in Computer Science

    Theoretical Foundations of Big Data Analysis

- **Spring 2014**

    Evolutionary Biology and the Theory of Computing

    Quantum Hamiltonian Complexity

- **Fall 2014**

    Complexity and Algorithms in Algebraic Geometry

    Algorithmic Spectral Graph Theory

Symposium on Visions for the Theory of Computing
May 29-31, 2013

- Bernard Chazelle, Princeton

- David Haussler, UC Santa Cruz

- Jeff Hawkins, Numenta

- Shafi Goldwasser, MIT

- Jon Kleinberg, Cornell

- S. Muthukrishnan, Google

- Christos Papadimitriou, UC Berkeley

- Judea Pearl, UCLA

- John Preskill, CalTech

- Al Roth, Stanford

- Ned Seeman, NYU

- Avi Wigderson, Institute for Advanced Study

Resources

A. Simons Foundation

- $6M per year for 10 years (plus prospect of endowment): $4.5M net per year after overhead and building renovation.

B. Campus Contributions

- Calvin Hall;
- Two Senior Scientist positions joint with campus departments.
- Allocation of two FTE of floating faculty release time to participate in the Institute;
- Graduate Fellowships;
- Chancellor's Visiting Professorship (one semester per year);
- 50% start-up funds for 7 Institute-related faculty campus-wide.

C. Faculty Hiring

- Prasad Raghavendra joined the faculty in fall 2012;
- Commitment to hire two Senior Scientists split 50/50 with Institute.

Main Scientific Activities

- Based around semester-long programs;

- Typically two programs per semester;

- Ongoing worldwide solicitation of program proposals;

- Annual review of proposals by Scientific Advisory Board ;

- Final selection of programs 1.5 – 2 years before start date;

- Programs will be judged on scientific merit and on alignment with mission of the Institute.

Anatomy of a Program

Approximately 35 long-term participants, including:

- 3-5 program organizers
- 6-10 visiting and Berkeley faculty
- 6-10 postdocs
- 10-20 visiting and Berkeley graduate students

Additional influx of approximately 35 people for each of three week-long workshops.

Sample Semester Program Schedule

- **Weeks −2 to 2**
  Preparatory intensive summer/winter school for graduate students, postdocs and other program participants, taught by program faculty.

- **Weeks 5, 10 and 15**
  Week-long program workshops (~70 participants each), with proceedings viewable via live webcast.

- **Ongoing**
  Two weekly seminars in-house, plus two broadly accessible Simons Lectures per semester presented at the Banatao Auditorium (4 total per semester).

- **1 Year after program**
  Week-long follow-up workshop organized by the program's postdocs.

Additional Events

- Biennial Symposium showcasing the Institute's achievements (patterned after our 2002, 2006/7, 2011 Symposia);

- Summer workshops (1 day to 2 weeks) on fast-breaking research topics, more speculative topics, or worthy topics that were not selected for full programs;

- IEEE *FOCS* Conference (odd years, starting in 2013);

- Advanced graduate courses on campus linked to programs (in addition to the summer/winter preparatory schools);

Impact on Faculty Hiring

- Two Senior Scientists to be hired in next three years (50% campus, 50% Institute);

- Total of ten campus positions total over ten years associated with the mission of the Institute

Impact on EECS Research Environment

Potential for faculty/student involvement in programs on, e.g.:

- Image processing
- Robotics
- Communication Theory
- Databases/Privacy
- Security

- Computational Science
- Neuroscience
- Nanotechnology
- Machine Learning

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• ~20 programs during the lifetime of a typical grad student;

• Every grad student should find at least one program that's exciting, relevant, and mind-broadening;

• Also: stronger ties with natural & social sciences on campus.

CALVIN HALL

New Initiatives

- Outreach

   Public events
     K-12 education

- Collaboration with Industry

For further information, contact:

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Thank you.

Achievements

- Appointment of Kristin Kane (Managing Director) and two additional staff
- Calvin Hall renovation (ongoing)
- Appointed Scientific Advisory Board and held three meetings
- Planning of six programs and two workshops for years 2013 – 2014
- Initiated external search for a Senior Scientist
- Selection of 32 Simons Fellows to participate in Fall, 2013 and Spring, 2014 programs (ongoing)
- Symposium on Visions of the Theory of Computing (May 2013, planning ongoing)
- Turing Centenary celebration (September 2012)
- Website development and branding design (ongoing)

Challenges

- Completing renovation and landscaping of Calvin Hall;

- Joint agreements with key IT companies and research organizations;

- Educational activities with K-12 students and teachers.

SIMONS INSTITUTE
FOR THE THEORY OF COMPUTING

Governance Board

Graham Fleming
Vice Chancellor for Research

Scientific Advisory Board

Richard Karp
Founding Director

Executive Assistant
(1 of 2)

Research Support & Accounting
(ERSO)

Director of Administration

Alistair Sinclair
Associate Director

Christos Papadimitriou
Senior Scientist (1 of 2)

Fundraising Support
(URel, CoE, L&S)

Executive Assistant
(1 of 2)

IT and AV Services
(Eric Fraser, EECS)

Program Organizers
(4 per program)

Program Officer

Public Affairs Manager

Program Attendees
(visiting faculty,
UC Berkeley faculty,
postdocs,
graduate students)