

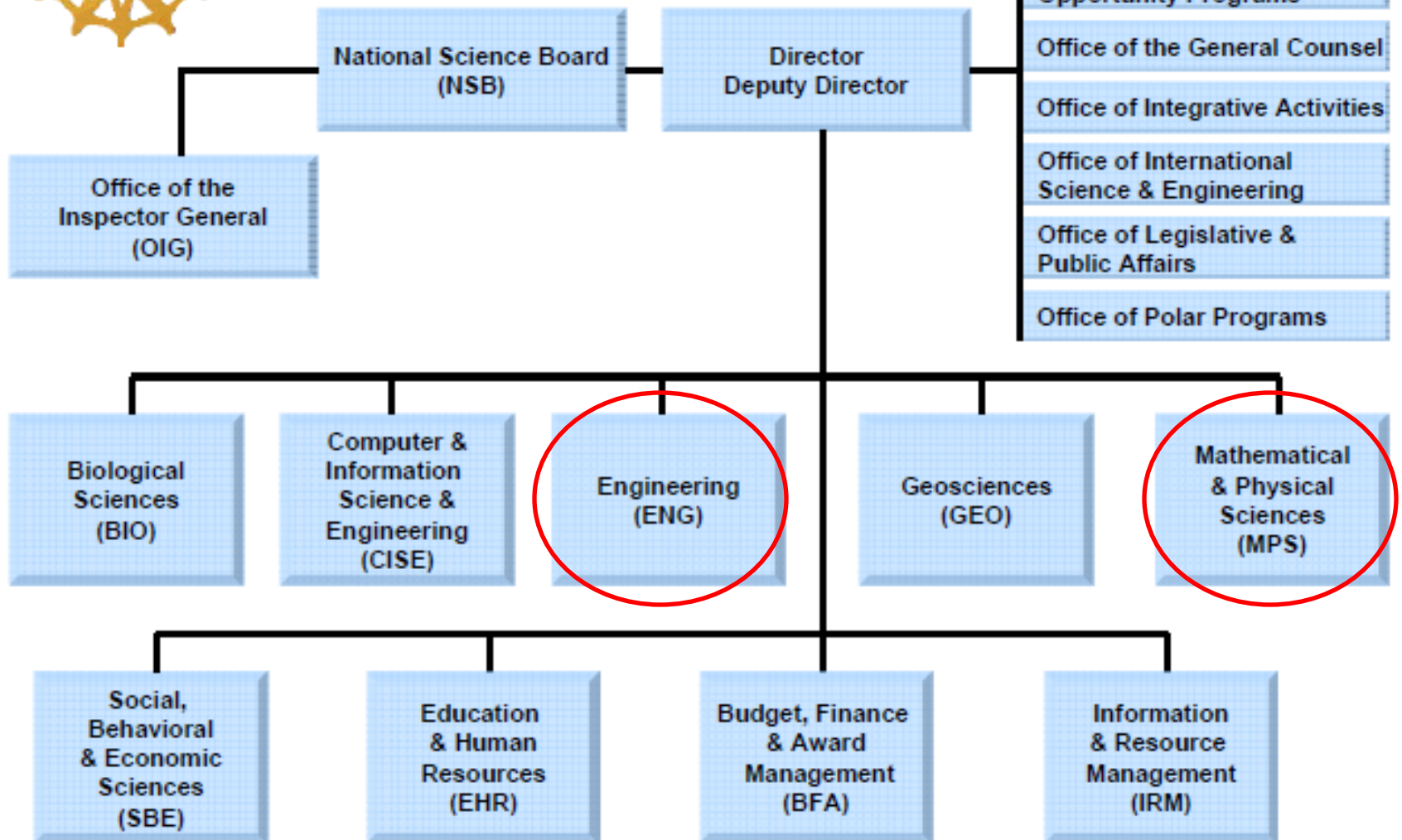
A pair of hands is shown from the bottom, cupping a glowing, blue and white globe of the Earth. The globe is illuminated from below, creating a bright glow around its base. The background is dark, making the hands and the glowing globe stand out prominently.

**NSF Workshop on Catalyzing Innovation in PV
Manufacturing:
Mathematical and Physical Sciences**

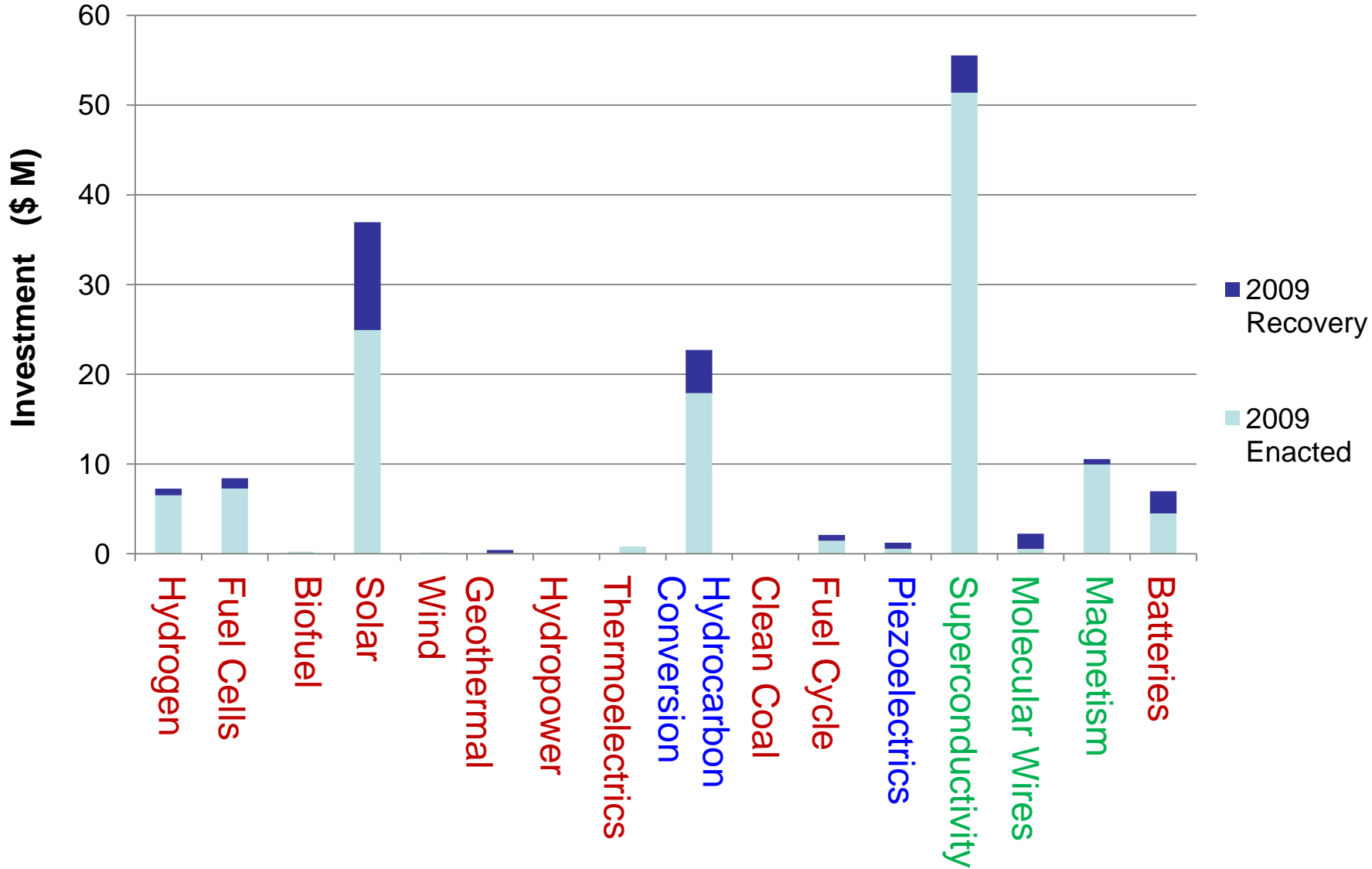
**Carol Bessel, Chemistry
703-292-4945; cbessel@nsf.gov**



NSF Organizational Chart

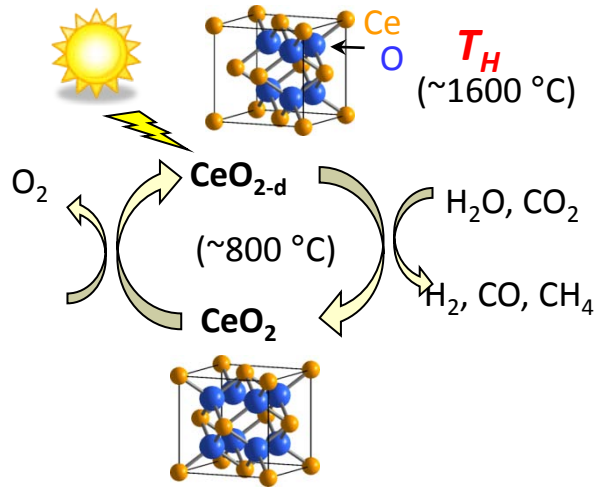
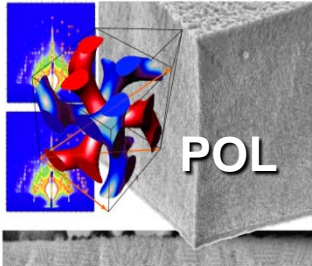


2009 MPS Energy Portfolio

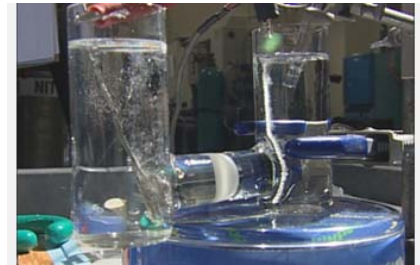
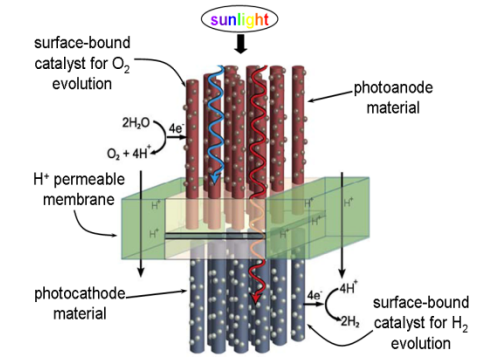


Solar Energy

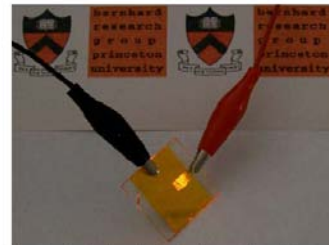
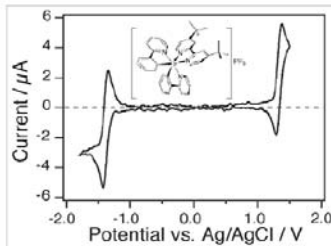
Solid-state dye-sensitized solar cell: Wiesner Cornell U.



Thermochemical Production of Fuels
Sossina M. Haile - Cal Tech



CCI: Powering the Planet:
Harry Grey - Cal Tech

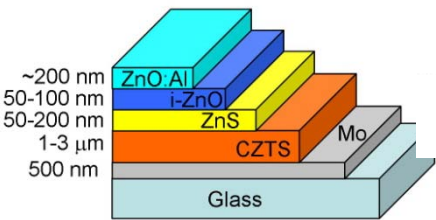


Photovoltaics

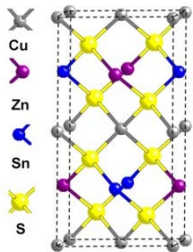
Stefan Bernhard, Princeton U.

Renewable Energy Materials Research
Science and Engineering Center
(MRSEC)

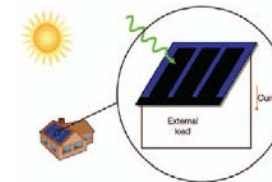
Craig Taylor, Colorado School of Mines



Copper Zinc Tin Sulfide
(CZTS)-Based Solar
Cells: Eray S. Aydil
and Stephen Campbell
- U. Minnesota



Flexible silicon solar cell



Roof-top Solar Panels





Centers for Chemical Innovation (CCI)

Powering the Planet Center for Chemical Innovation (CCI Solar)

focuses the efficient and economical conversion of solar energy into stored chemical fuels.

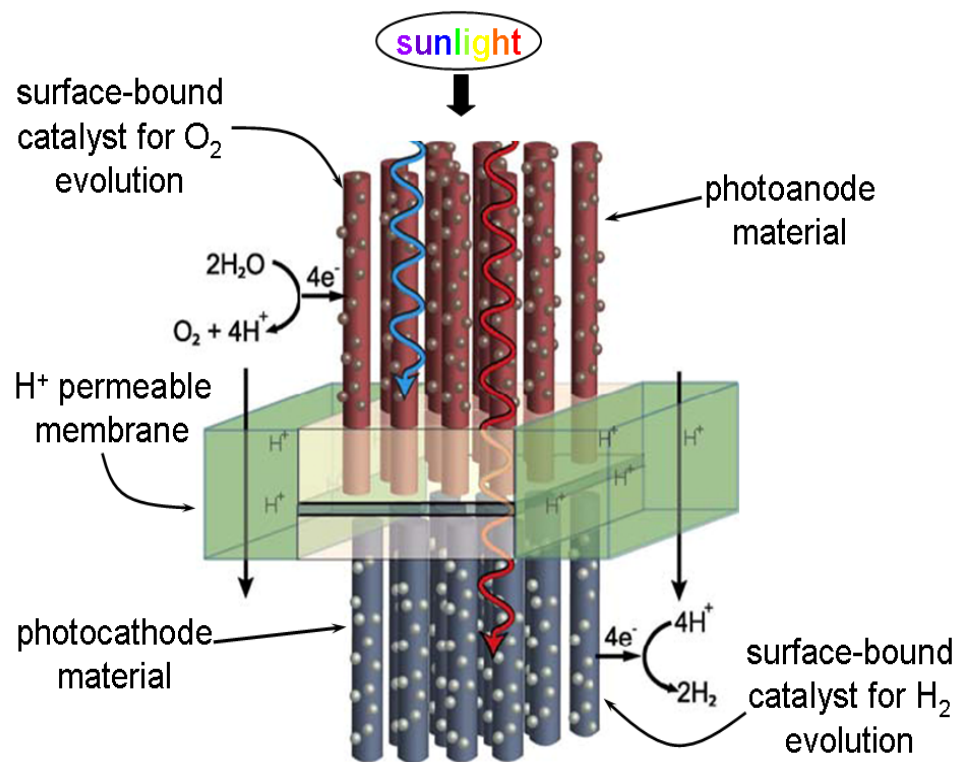
Lead PI: Harry Gray

NSF Funding: \$8.0 million

Lead Institution:
California Institute of Technology

Duration: 2008-2013

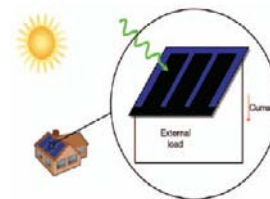
Photocatalytic Water Splitting



<http://www.ccisolar.caltech.edu>

Renewable Energy Materials Research Science and Engineering Center

- ❖ MRSEC at the Colorado School of Mines (CSM), Sept. 2008, PI: Craig Taylor
- ❖ Focus on renewable energy applications: *photovoltaic materials* and *fuel-cell membranes*
- ❖ Education of the next generation of energy professionals
- ❖ \$9.3M over 6 years: DMR and OMA
- ❖ Collaborations
 - NREL
 - 20 industrial companies



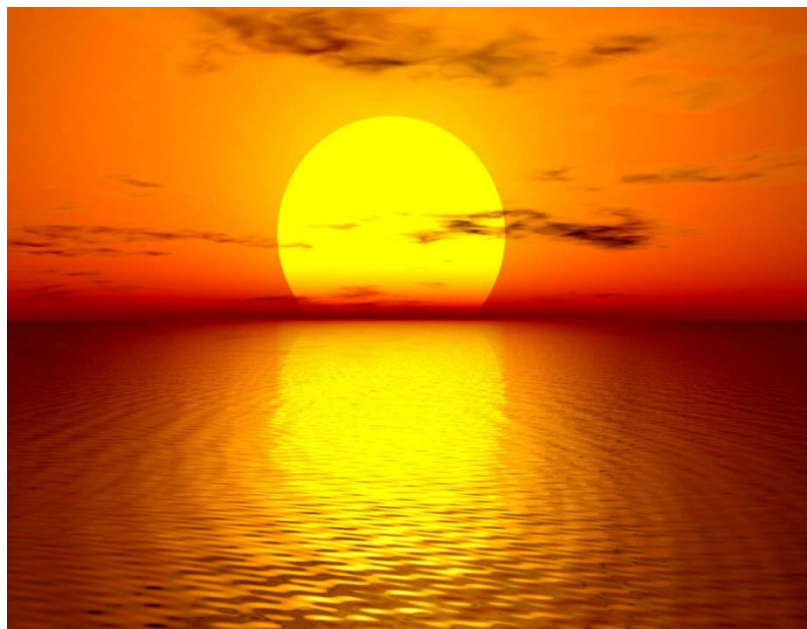
CHE-DMR-DMS SOLAR 2010

Goal: To create a new modality of linking the mathematical with the chemical and materials sciences to develop transformative paradigms in an area of much activity, but largely incremental advances.

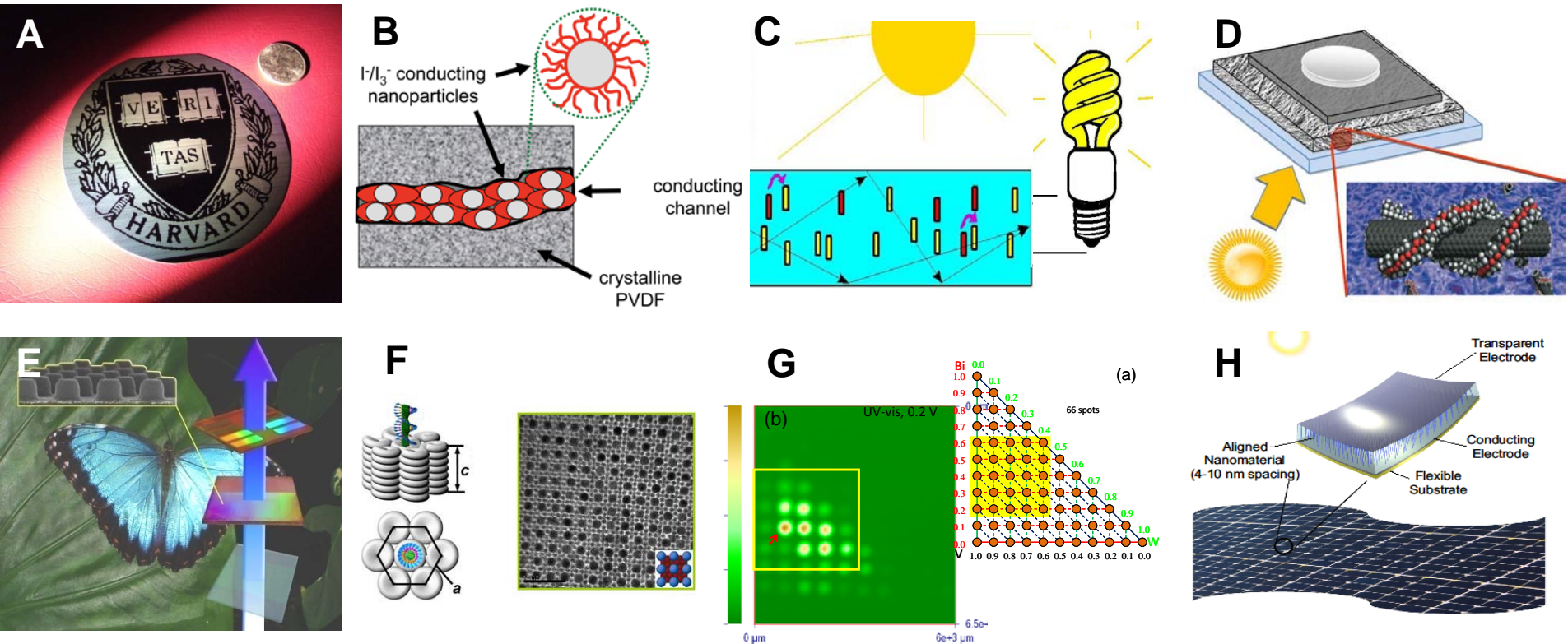
Requirements: Each group must include three or more PIs with demonstrated high expertise in chemistry, materials research and mathematical sciences. Pre-proposal submission has been required.

Awards: \$500 K/y for three years depending on scope of proposal. 3-10 awards per year dependent on availability of funds.

- Preliminary proposals: 2009: 126 reviewed / 31 encouraged (25%); 2010: 102 reviewed / 30 encouraged (29%)
- Full proposals: 2009: 8 proposals awarded (26%, increased by ARRA funding); 2010: to be determined



CHE-DMR-DMS SOLAR Energy Initiative



2009 Awardees: **A.** Optical hyperdoping: Transforming **semiconductor band structure** for solar energy harvesting: Mazur, Aspuru-Guzik, Brenner, Friend, Harvard Univ.; **B.** Design and development of efficient solid-state **dye-sensitized solar cells**: McCusker, Baker, Christlieb, Drzal, Promislow, Michigan State Univ.; **C.** Luminescent **solar concentrators** based on semiconductor nanorods, Kelley, Leppert, Ilan, U. CA at Merced ; **D.** Ultrabroad spectral bandwidth excitonic **thin-film solar cells** based on carbon nanotubes, Forrest, Krasny, Rosen, Thompson, Wang, U. Michigan Ann Arbor; **E.** Integrated electro-photonic development of **polymer solar cells**, Samulski, Lopez, Mitran, UNC Chapel Hill; **F.** Programming the **self-assembly** of matter for solar energy conversion, Kagan, Epstein, Ghrist, Murray, Percec, U PA; **G.** High-efficiency solar generation of **hydrogen fuel** from novel "tuned" electrocatalytic nanostructures, Bard, Gamba, Mullins, U TX Austin; **H.** **Novel nanomaterials** and mathematical analysis for ultra-high efficiency photovoltaic systems: A new paradigm in solar cells, Pfefferle, Coifman, Ismail-Beigi, Osuji, Taylor, Yale Univ.

CHE-DMR-DMS SOLAR Program

- 2009 MRS Fall Meeting: Third-Generation Solar Technologies Multidisciplinary Workshop, Boston, MA; Nov. 30 - Dec. 4, 2009
- 2010 Joint Initiative of the North American Mathematical Institutions: Climate Change, Sustainability and the Mathematical Sciences, San Francisco, CA; Jan. 13-16, 2010
- 2010 MRS Spring Meeting: Third-Generation Solar Technologies Multidisciplinary Workshop, Boston, MA; April 5, 2010
- 2010 MPS/SBE Workshop – “Solar Sustainability, Risk and Society” – to be determined.



Institute for Mathematics and Its Applications

Hot Topics Workshops and Special Events

IMA Special Workshop:

Scientific Challenges in Solar Energy Conversion and Storage

November 1, 2008

Organizers:
Eray Aydil Chemical Engineering and Materials Science, University of Minnesota
Weinan E Mathematics and Program in Applied and Computational Mathematics, Princeton University

Schedule	Participants	Program Application	Feedback
IMA Live Streaming and Webcasting			Maps
Abstracts and Talk Materials		Dining Guide	
University of Minnesota Press Release			

Description:

The Institute for Mathematics and its Applications (IMA) in conjunction with the National Science Foundation Division of Math Sciences is organizing a one-day workshop on the new initiative called SOLAR http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503298.

Science, Engineering and Education for Sustainability (SEES)

MPS is partnering with other NSF Directorates to invest in climate and energy research

- Energy
 - SOLAR program
 - Novel earth-abundant materials for solar energy harvesting, creating efficient solar cells
 - Efficient materials for direct conversion of photons into hydrogen via water electrolysis
 - Energy Storage
 - New battery materials could “charge in seconds”
- Climate
 - New algorithms improve atmospheric and ocean simulations with parameterized uncertainties in physical processes, which typically hamper climate change predictions

SEES request:
\$110.50 M



FY2010 Estimate: \$661 M
FY2011 Request: \$766 M