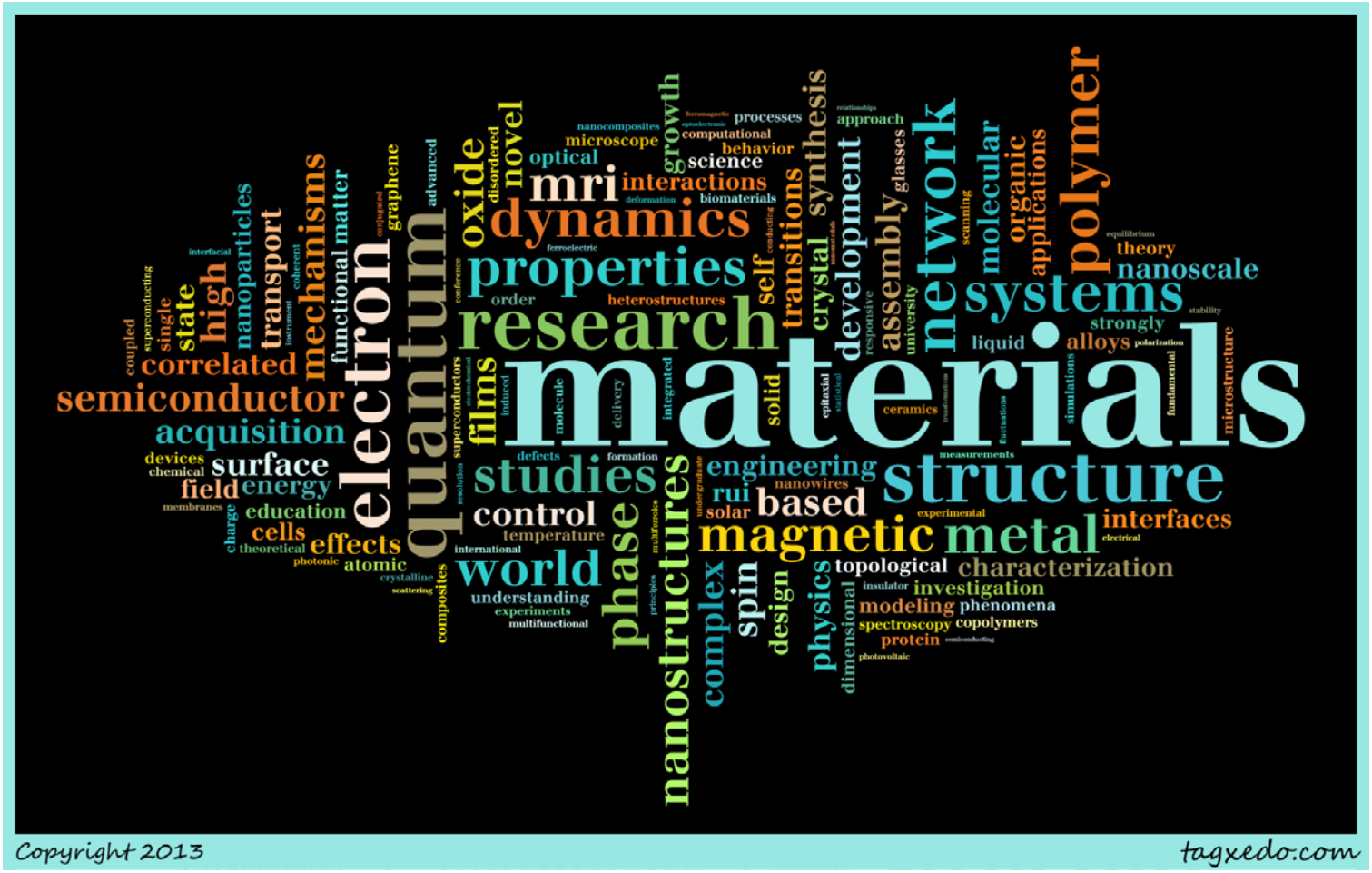
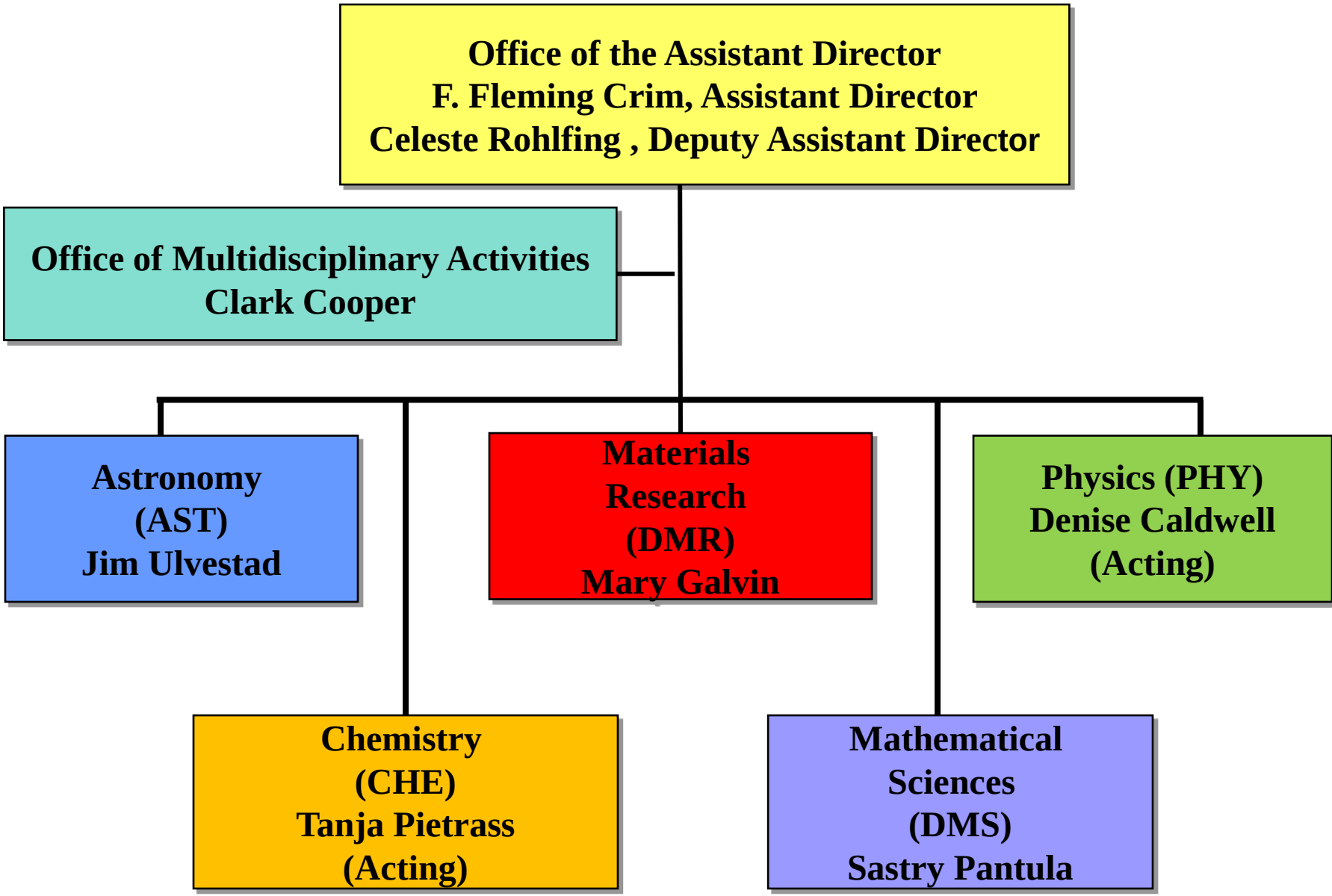
Division of Material Research (DMR)
Mary Galvin, Division Director

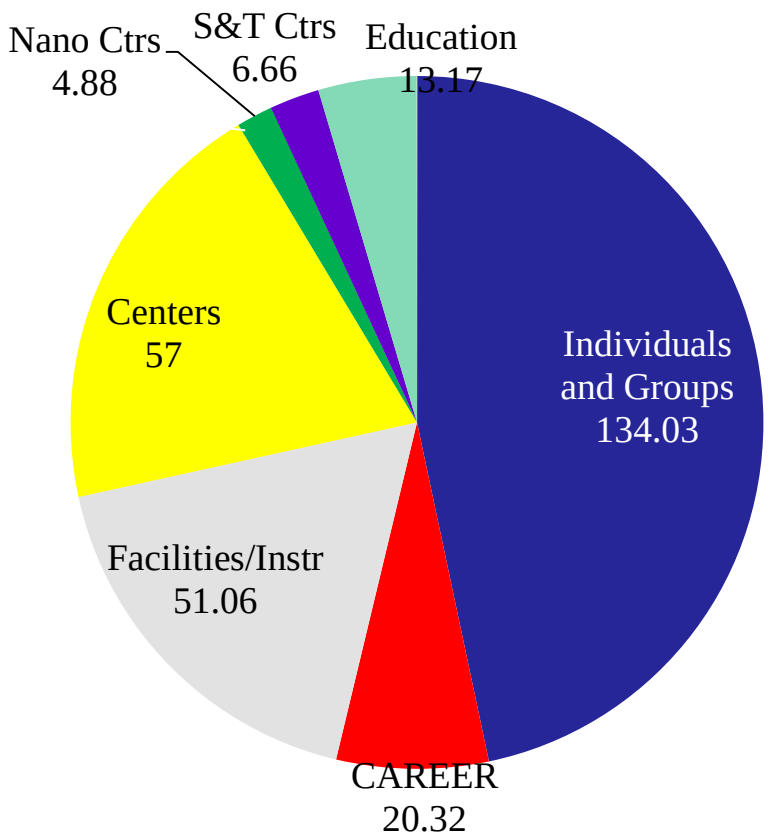


Directorate of Mathematical and Physical Sciences (MPS)

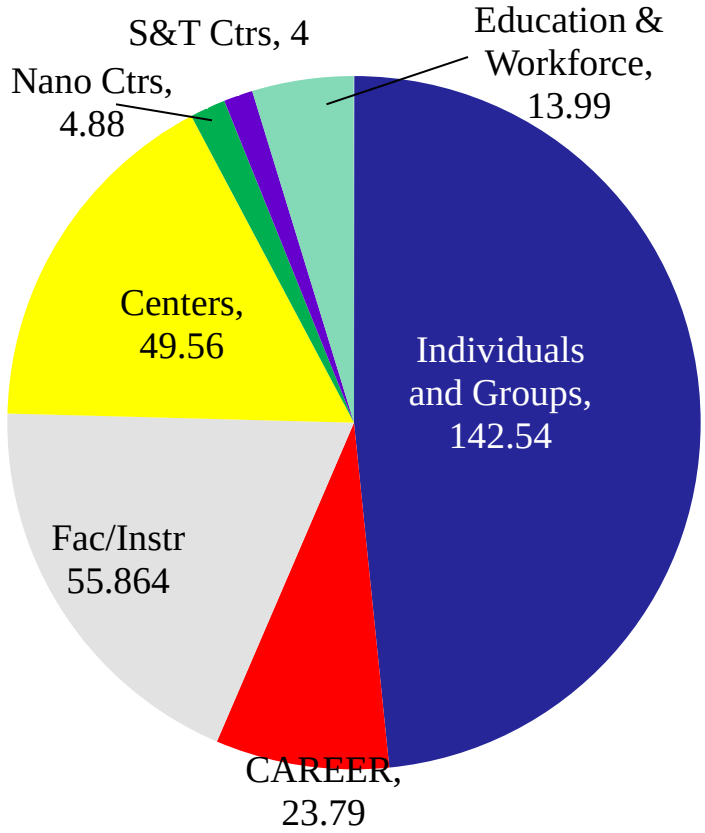


DMR Budget

FY 2011: $287 M

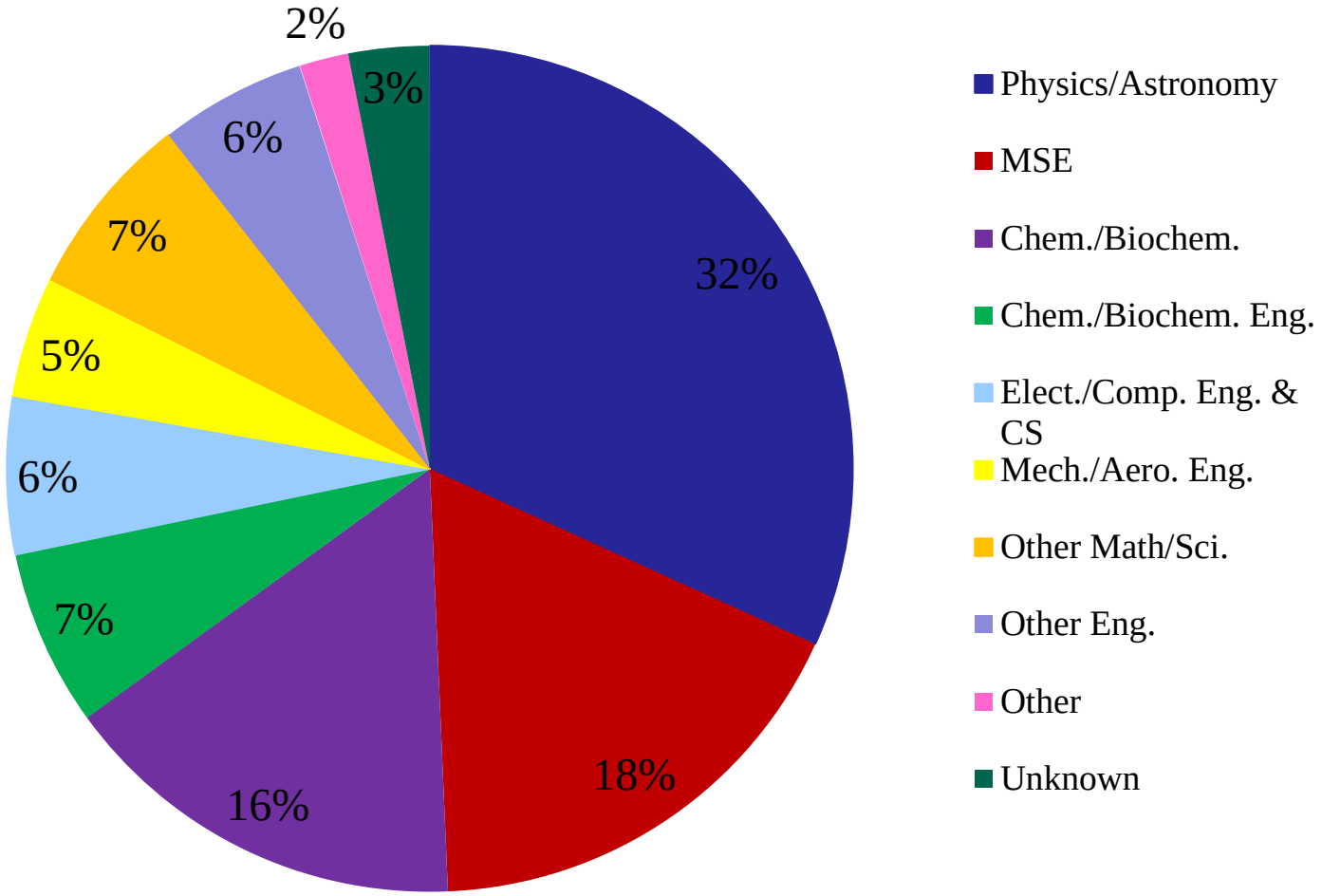


FY2012: $295M



57% to Individual Investigators
20% to Facilities
20% to Centers (MRSEC, Nano and STC)

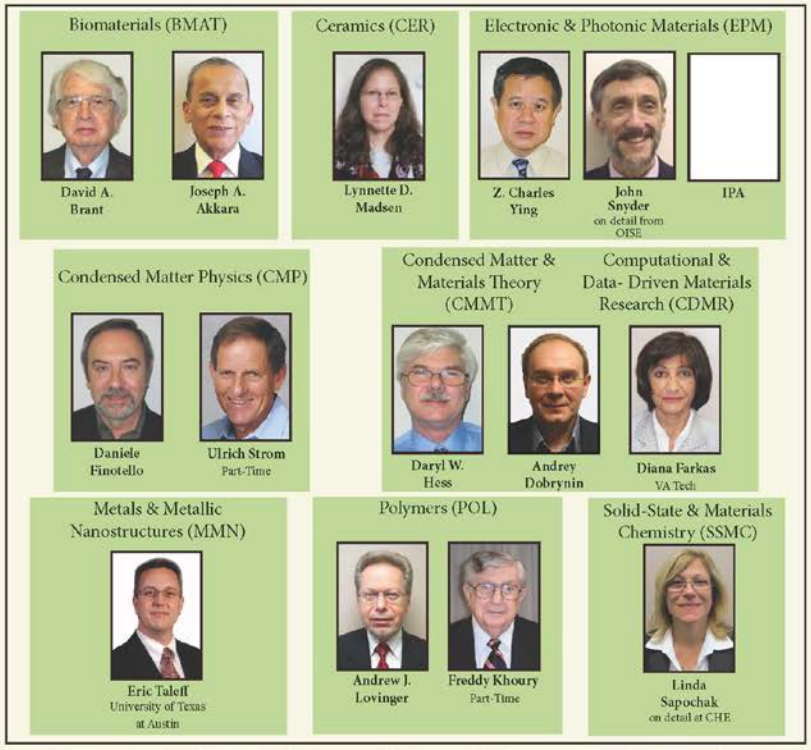
PI Distribution DMR

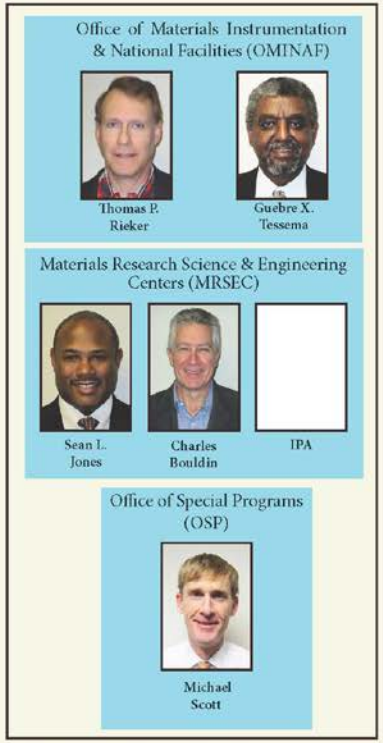


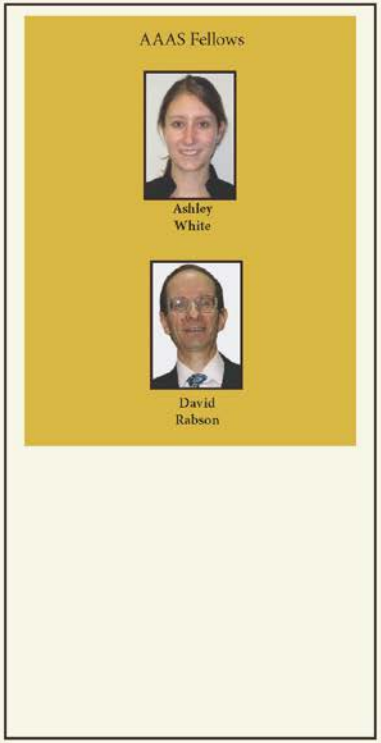
*But diverse as they are, materials scientists look at materials from a unified point of view: they look for connections between the underlying **structure** of a material, its **properties**, how **processing** changes it, and what the material can do - its **performance**.* (From Strange Matter)

Division of Materials Research (DMR)

Program Directors

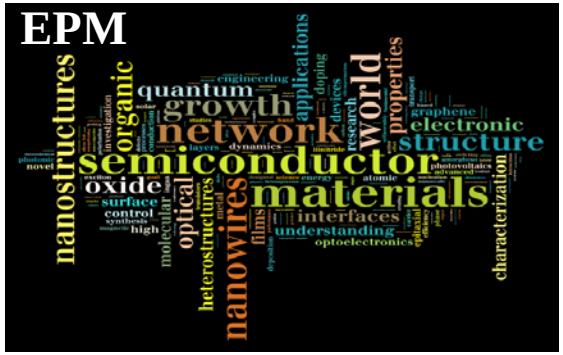




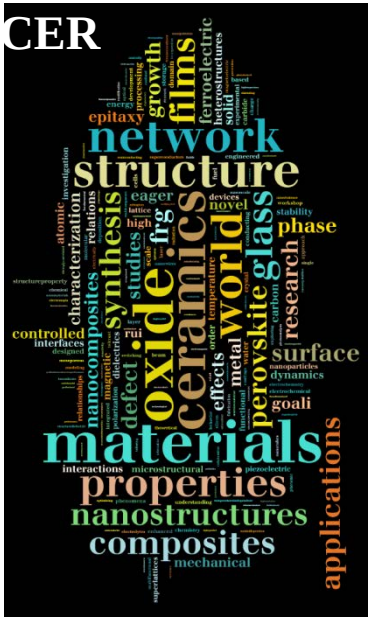


Individual Investigator Programs organized by material type and discipline.

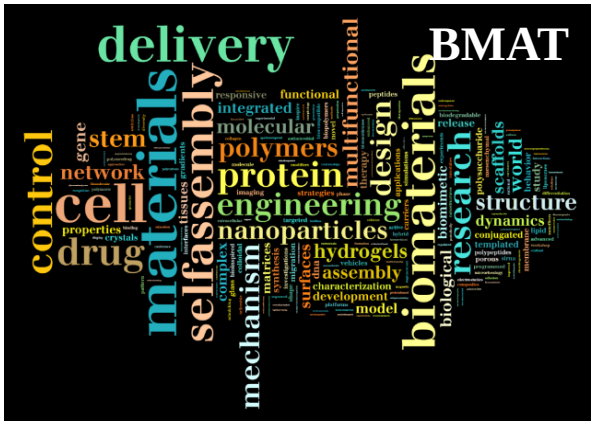
Materials Type



PD: Charles Ying

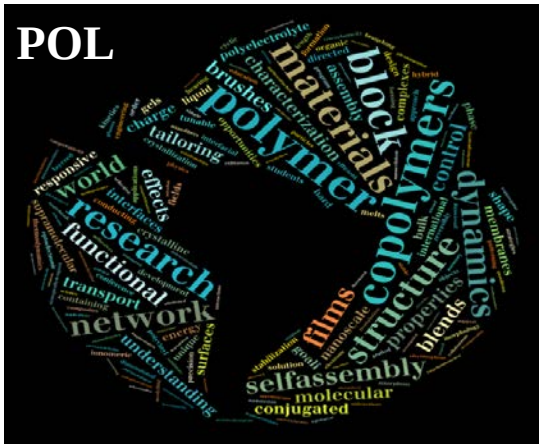


PD: Lynnette Madsen



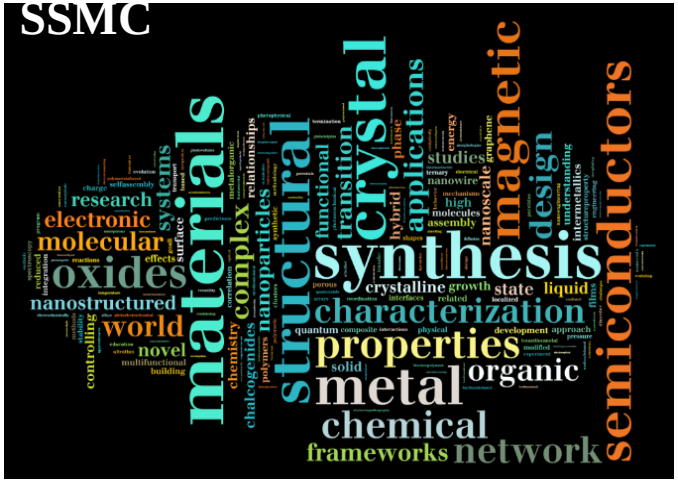
PDs: David Brant, Joseph Akkara

PD: Eric Taleff

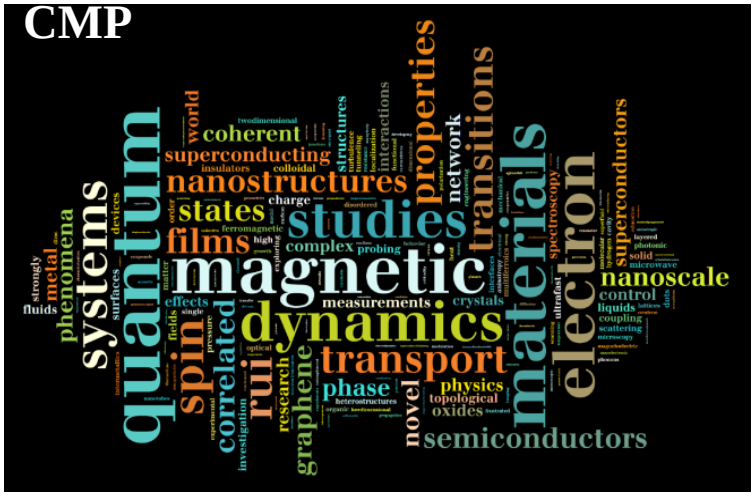


PD: Andrew Lovinger

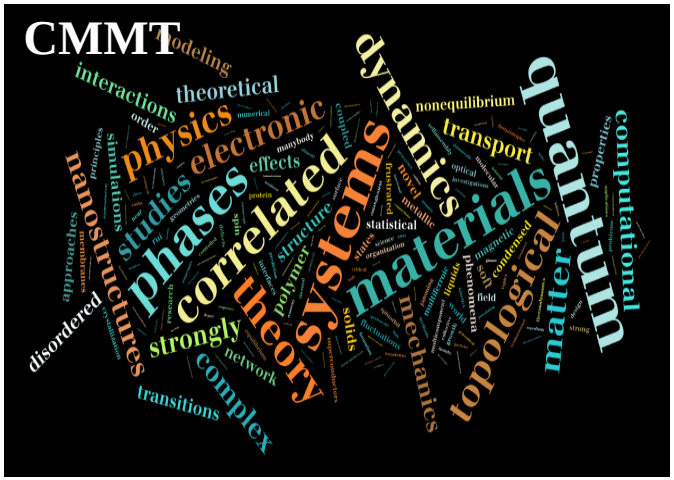
Discipline



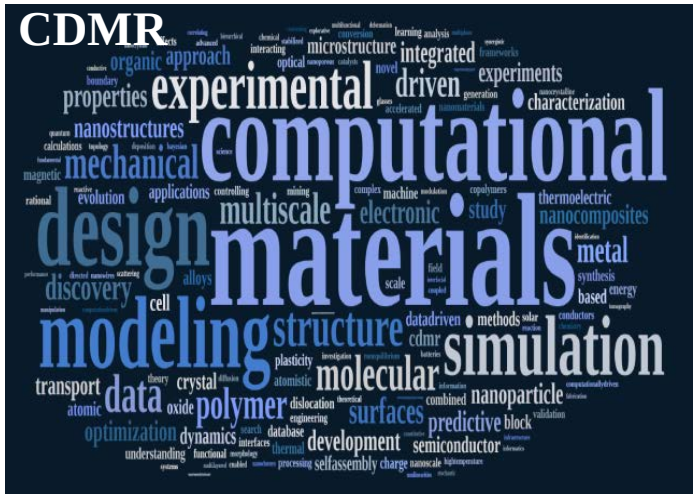
PD: Suk-Wah Tam-Chang



PD: Dan Finotello

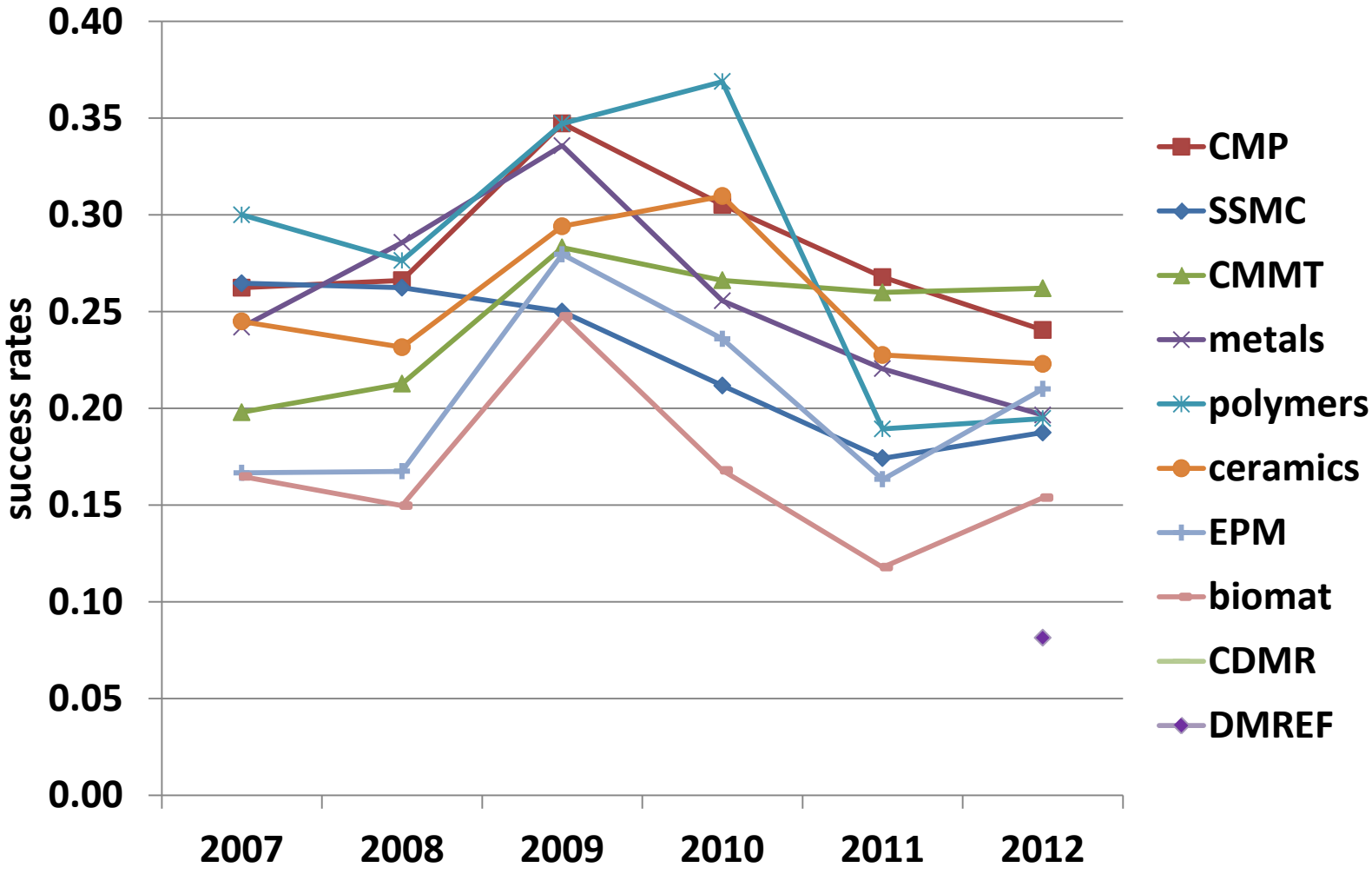


PDs: Daryl Hess
Andrey Dobrynin



PD: Diana Farkas

Program Success Rate



Discovery

Spin Liquid in a realistic system (UC Irvine)

Nanoscale Assembly by Algorithmic Design (U. Penn)

Extended Spin Lifetimes in Bilayer Graphene (UC Riverside)

Biodesigning Advanced Nanocomposites (Northwestern)

Topological Insulators (Princeton)

Very Large Magnetoresistance in Graphene Nanoribbons for High Performance Electronics UCLA

Electrically- and Optically-Controlled Self-Assembly in Liquid Crystals (Colorado)

OPTICALLY HEALABLE MATERIALS (Case Western)

Quantum Transport in High Mobility Graphene (MIT)

Plasmonic Dye Sensitized Solar Cells (Cornell)

Single-Chirality Single-Walled Carbon Nanotubes (Northwestern)

Highly complex 3-D nano-objects by DNA origami (Arizona State)

Experimental Investigation of Plasticity at Nanoscale (Cal Tech)

Self-assembly on elastic surfaces (Columbia)

Materials Research Science and Engineering Centers (MRSECs): High Impact - High Visibility

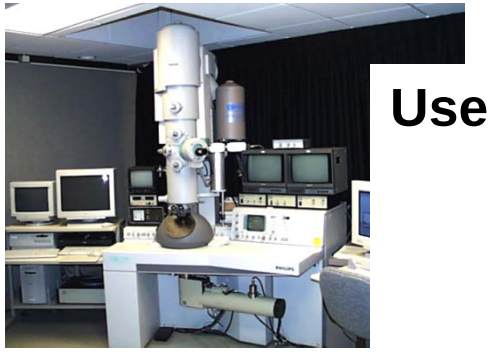
23 MRSECs Going Forward

- 58 Interdisciplinary Research Groups (IRGs)

2010-2011 Data for 27 Centers

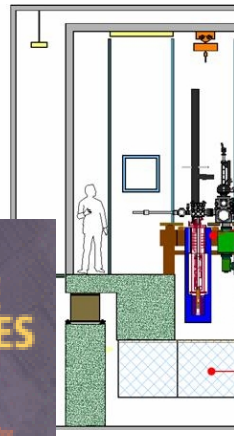
- 901 Faculty participants
- 224 Ph.D.s awarded
- 129 Post-docs completed
- 1500 publications
- 76 patents issued

Infrastructure

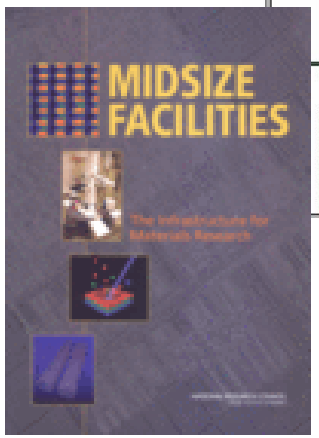


Users of MRSEC Facilities

> 2000/yr Academic
> 550/yr Industry
>100/yr National Labs



Over 500 Publications annually



Shared Facilities Workshop in 2011

- 77 Technical Staff in SEFs
- 31 Other Technicians
- 70 Administrative Staff
- 28 Education Staff

MRFN

Materials Research Facilities Network

Job Creation (Harvard MRSEC)

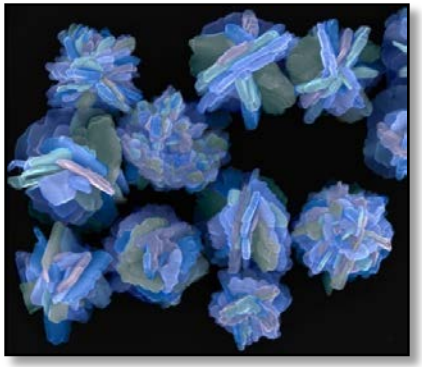
- **2002-2011**
- Research supported by the Harvard MRSEC has led to the creation of many start-up companies that are exploiting the technologies developed in the MRSEC. Together, the companies have created more than 250 new high-quality technical jobs, providing valuable employment opportunities for the graduate students and postdoctoral fellows from Harvard's MRSEC and contributing to the economic vitality of our country. Contributors from the Harvard MRSEC include George Whitesides, Eric Mazur, Dave Weitz. A partial list of these start-ups, including an estimate of the number of employees, is below.
-
- Surface Logix (30) http://www.surfacelogix.com;
- Cambridge Nanotech (25) http://cambridgenanotech.com;
- RainDance Technologies (90) http://www.raindancetech.com;
- NanoTerra **(**25) http://www.nanoterra.com;
- SiOnyx, Inc. (15) http://www.sionyx.com
- Capsum (15) http://capsum.eu
- HabSel (2) http://www.habsel.com
- GnuBIO (15) http://www.gnubio.com/
- MC10 (30) http://www.mc10inc.com
- Diagnostics for All (10) http://www.dfad.org

DMR

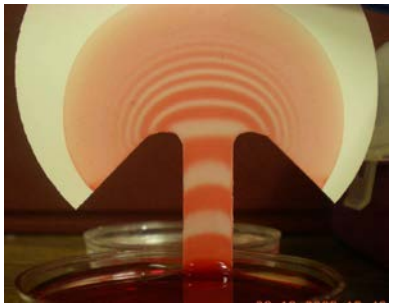
National Science Foundation

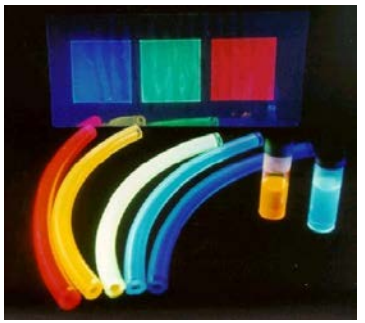
The Partnership for Research and Education in Materials (PREM) Program

… to address the pipeline of under-represented minority materials scientists…



The Division of Materials Research (DMR) seeks to broaden participation in materials research and education by stimulating the development of long-term, collaborative partnerships between minority serving institutions and DMR-supported groups, centers, institutes, and facilities.





Managing the Nation's Multidisciplinary User Facilities for Research

Stewardship: OMINaF Provides high cost and unique experimental capabilities to the DMR community.

- **Cornell High Energy Synchrotron Source**
- **National High Magnetic Field Laboratory**

Partnership: OMINaF partners with others to provide resources to the DMR community.

- With NIST: The Center For High Resolution Neutron Scattering (CHRNS) at the NIST Center for Neutron Research
- With DOE: The Intermediate Energy X-Ray (IEX) beamline 29-ID currently under construction at the Advanced Photon Source.
- With NSF/Chem: ChemMatCARS Beamline at the Advanced Photon Source
- With NSF/ENG: National Nanotechnology Infrastructure Network (NNIN)

DMR Materials World Network

Corresponding submissions to NSF and to national/regional funding agencies abroad

Parallel (most cases) or single joint review (UK, Germany)
DMR reviews proposals within programmatic areas

8-10 topical panels, include non-US panelists

NSF standard review criteria (intellectual merit and broader impacts) *and*
value added by international collaboration
balance of intellectual efforts in the US and abroad
participation of junior researchers in international research experiences

Coordination with foreign funding agencies for joint identification of awards

NSF funds US institutions; organizations abroad fund their researchers

NSF supports all costs associated with the research in the US side (not just mobility)

NSF Initiatives

DMREF

Designing Materials to Revolutionize and Engineer the Future

In Response to **Materials Genome Initiative**

Discovery to Deployment - "Twice as Fast, a fraction of the cost"

Extremely ambitious goal! - So how do we start?

MPS: DMR, CHE, DMS
ENG: CMMI, CBET
CISE

REQUIREMENTS FOR SUCCESSFUL DMREF PROPOSALS

- Proposals due Jan 15th – Feb 15th
- Must go beyond simple collaborations. Focused research groups (3-5 faculty) encouraged.
- Must accelerate materials discovery.
- Data must drive theory/simulation and theory/simulation must drive experiments: Iterative process.
- Want significant advances in all components of the project (making materials, experimental characterization and structure determination, simulation/theory).
- Must provide open access to algorithms and data.
- **Must go beyond:**
  - Simply including theoretical and computational research.
  - Simply comparing theory/simulation and experiment.
  - Collaborations already funded in DMR.

FURTHER INFORMATION FOR DMREF

DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES (MPS)

CHE

- Dr. Timothy Patten (tpatten@nsf.gov)

DMR

- Dr. Mary Galvin (mgalvind@nsf.gov)
- Dr. Linda Sapochak (lsapocha@nsf.gov)
- Dr. Dan Finotello (dfinotel@nsf.gov)
- Dr. Diana Farkas (dfarkas@nsf.gov)

DMS

- Dr. Michael Steuerwalt (msteuerw@nsf.gov)

DIRECTORATE FOR ENGINEERING (ENG)

CMMI

- Dr. Clark Cooper (ccooper@nsf.gov)
- Dr. Martin Dunn (mldunn@nsf.gov)
- Dr. Mary Toney (mtoney@nsf.gov)

CBET

- Dr. Ashok Sangani (asangani@nsf.gov)

Computer & Information Science and Engineering (CISE)

- Ralph Wachter

Sustainable Chemistry, Engineering and Materials (SusChEM)

SusChEM proposals are expected to take a systems-based approach to understanding, predicting and facilitating advances towards global sustainability.

One NSF APPROACH – 5 Divisions

MPS – Chemistry (CHE), Materials (DMR)

ENG – Division of Chemical, Bioengineering, Environmental and Transport Systems (CBET) and Division of Civil, Mechanical and Manufacturing Innovation(CMMI)

GEO – Division of Earth Sciences (EAR)

Budget Request of $27.2M for FY2013

SusChEM: DMR

Promote Fundamental Research For:

- **Materials for the Preservation and Extension of Natural Resources:**
  - Enhance recyclability, reuse, repurposing, and/or reclamation
  - Extend the durability, lifetime, or enhance the biodegradability of materials
- **Material Replacement for a Safer and more Secure Future:**
  - Elimination of toxic elements/materials
- **Improved Materials during Operating Conditions:**
  - Increase the lifetime of materials (normal, extreme or harsh conditions)
  - Extend the operational range of materials to increase efficiency or efficacy
- **Materials Designed for Zero Waste:**
  - Minimize waste and/or emphasize the use of bio-related materials
  - Increasing the self-sensing, -repairing, -healing (smart) properties of materials
- Contact Sean Jones or Lynnette Madsen

Mathematical and Physical Sciences Directorate Sub-committee report on Materials Infrastructure. Materials 2022 Report

- To provide sustained financial investment that makes cutting edge instrumentation, especially **essential, new and unique instrumentation,** accessible to university-based research programs.
- To promote research on **development of new instrumentation** that advances experimental frontiers, maintains an inventive culture and enables new discoveries.
- To provide **access** to a full range of cutting edge commercial instrumentation.
- To provide **geographically distributed** access to a full range of equipment capabilities for materials synthesis, characterization and processing.
- To play a crucial role in the education of successive generations of instrument and facility users, developers and operators.
- To enable access to unique experimental capabilities that are beyond the scale of individual investigator laboratories.

I-Corps: Testing the Commercial Validity of NSF-funded Research

- **Team Based: Entrepreneurial Lead, PI and Mentor**
- **$50K to "Get out of lab"**
  - **Flexible funding, but NO additional technology research**
- **3-Month Curriculum**
  - **Serious**

- **Program Outcomes**
  - **Functioning network of Mentors/Advisors**
  - **Scientist and Engineers trained as Entrepreneurs**
  - **Increased impact of NSF-funded basic research**

- 30 Hours of Curriculum
- $50,000 per award
- F&A $5,000 maximum
- 25 awards in FY2011
- 100 awards in FY2012

Early-Concept Grants for Exploratory Research (EAGER)

Formerly: Small Grants for Exploratory Research (SGER)

- Supports **high-risk, exploratory**, and potentially transformative research
- Began Jan. 1, 2009
- Up to $300K over two years
- May be submitted any time; contact program officer prior to proposal submission

- **Also, Grants for Rapid Response Research (RAPID)** supports **research of great urgency**

INSPIRE

- **INSPIRE Track 1.** This is essentially a continuation of the pilot CREATIV mechanism from FY 2012, which address some of the most complicated and pressing scientific problems that lie at the intersection of traditional disciplines

- **INSPIRE Track 2.** These are "mid-scale" research awards at a larger scale than Track 1, allowing for requests of up to $3,000,000 over a duration of up to five years. Expectations for cross-cutting advances and for broader impacts are greater than in Track 1, and the review process includes external review.

- **Director's INSPIRE Awards.** These are prestigious individual awards to single-investigator proposals that present ideas for interdisciplinary advances with unusually strong, exciting transformative potential.

Before writing or submitting an INSPIRE proposal, PIs must make a formal inquiry by submitting a FastLane Letter of Intent (LOI).

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504852

Questions