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Where Materials Begin & Society Benefits



DMR Challenges

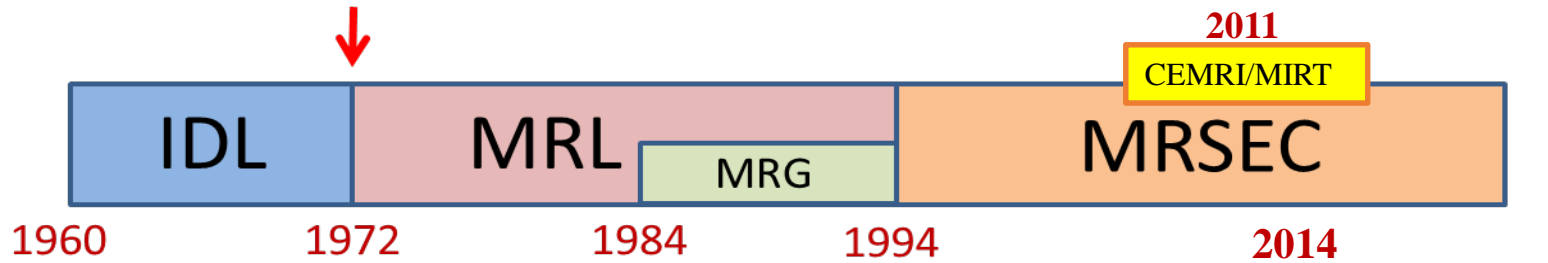
- **Balancing a diverse portfolio (Decadal Study in Progress)**
 - TMRPs, Centers, Teams, Facilities
 - Topical Materials Research Program (TMRPs)
- **Responding to a diverse community**
 - MRS, APS, ACS, TMS, AVS, ACers
 - Changing field – MGI – more teams vs. individuals.
- **Sustaining long-term funding**
 - Difficult to start something new (staffing and funding challenge).
 - Facilities – for the good of all science and engineering.
- **FTEs**
 - Since 2008 the number of proposals has more than doubled in some programs, but number of staff is reduced.
 - Efficiency is up, but diversity increases: process or manage?



1st general funding opportunity in US for interdisciplinary research

DMR's Beginnings....

NSF established DMR



IDL/MRL University	Year Started
Cornell	1960
Pennsylvania	1960
Northwestern	1960
Chicago	1961
Harvard	1961
MIT	1961
Pennsylvania State	1974
Ohio State	1982

1985 Engineering Res Centers

1989 Science & Tech Centers

Nanoscale Science & Engineering Centers

2001 NSEC

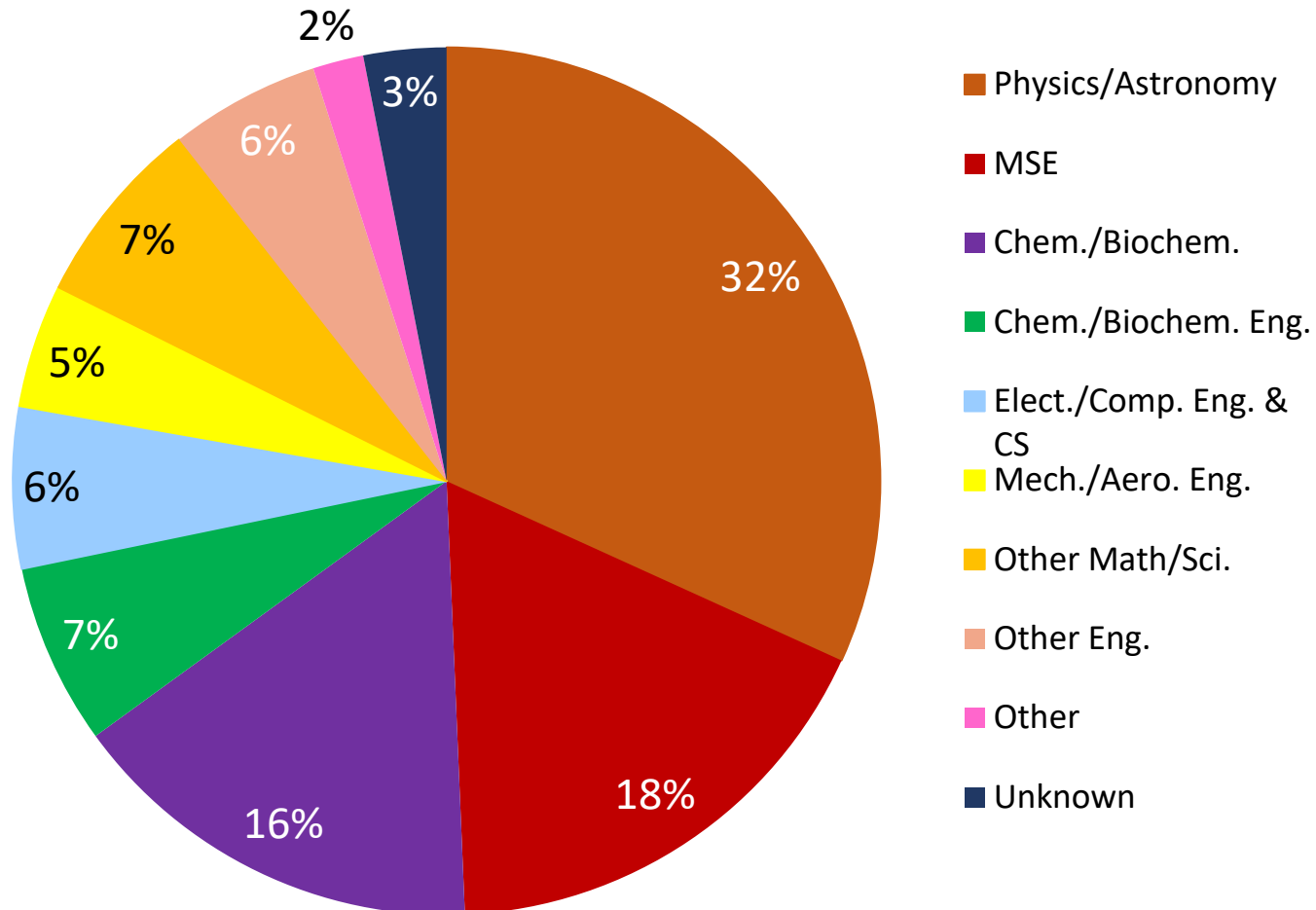
Physics Frontier Centers

2002 PFC

Centers for Chemical Innovation

2004 CCI

PI Departmental Affiliations



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DIRECTORATE FOR MATHEMATICAL AND PHYSICAL SCIENCES

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Kelsey Smith
Student Program Assistant



Aubrie TenEyck
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Elaine Washington
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Denise Williams
Program Analyst



Program Directors

National Facilities and Instrumentation



Leonard Spinu



Guebre X. Tessema



Charles Ying

Designing Materials to Revolutionize and Engineer our Future



John Schlueter



Eva Campo

Materials Research Science and Engineering Centers



Daniele Finotello



Mohan Srinivasarao

PREM



Eva Campo

Condensed Matter Physics



Tomasz Durakiewicz



Germano Iannacchione

Electronic and Photonic Materials



Miriam Deutsch



Tania Paskova

Condensed Matter and Materials Theory



Daryl W. Hess



Alex Klironomos

Solid-State and Materials Chemistry



Birgit Schwenzer



Eugene Zubarev

Metals and Metallic Nanostructures



Gary Shiflet

Polymers



Andrew J. Lovinger

Biomaterials



Alex Simonian



Ceramics



Lynnette Madsen

Cross-Cutting Activities

Divisional

Expert



Freddy Khoury

Last Updated: 10/11/2017

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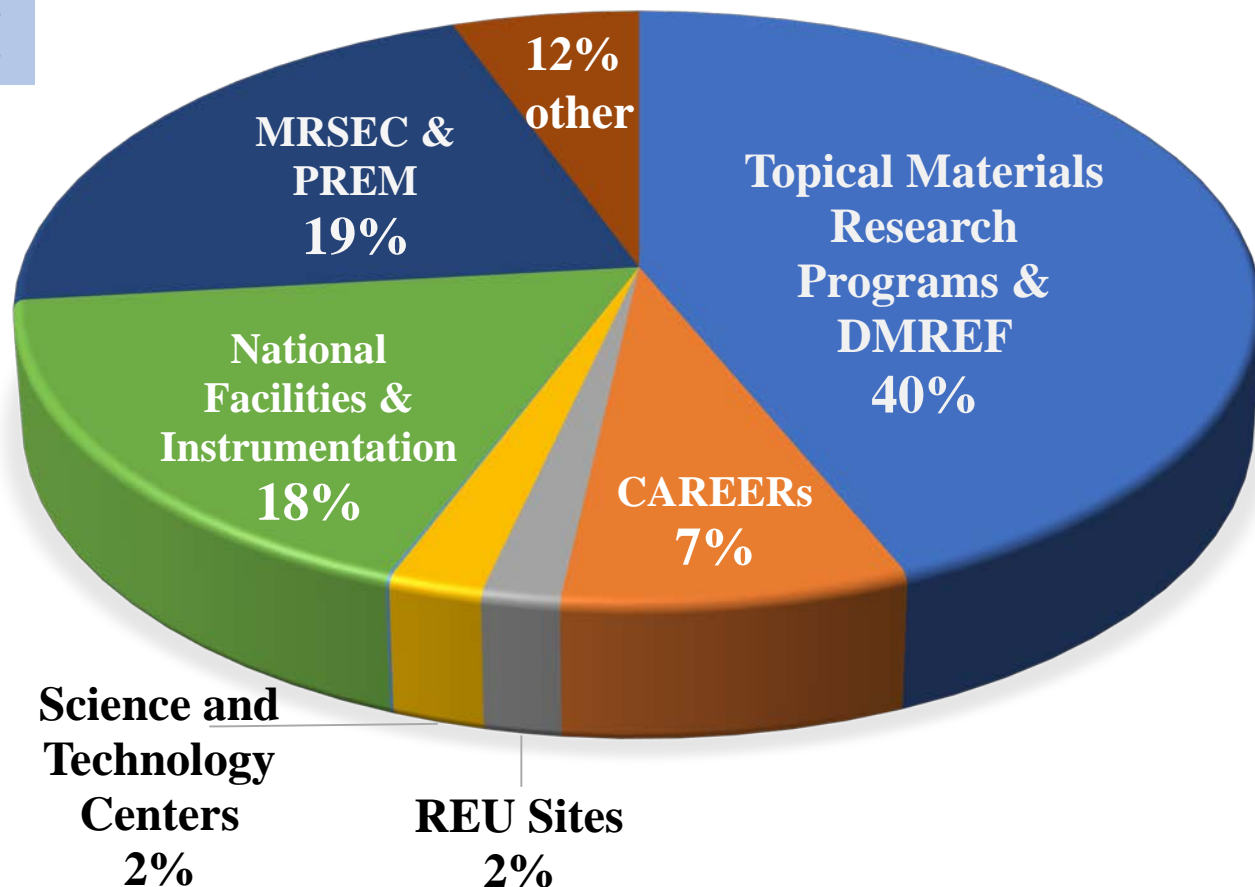


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FY15 \$307M
FY16 \$310M
FY17 \$314M
FY18R \$283M

DMR Budget Distribution



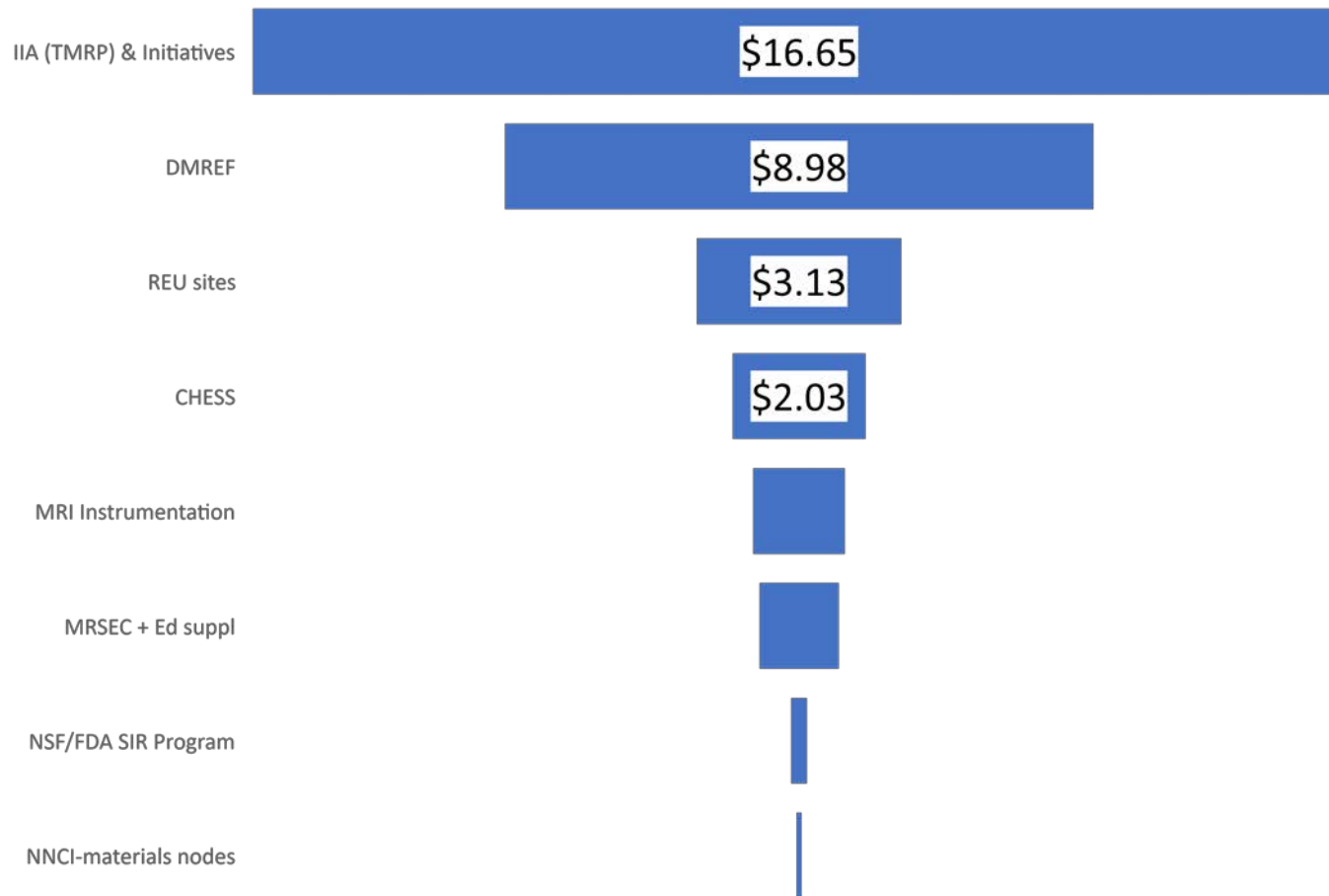
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DMR FY18 Request Budget Reductions



Reduce ~ 1 award per TMRP and eliminated initiatives that go to TMRPs

Running every other year

Rely on MRSECs, PREM, CHESS, and NHMFL infrastructure

Start transition early

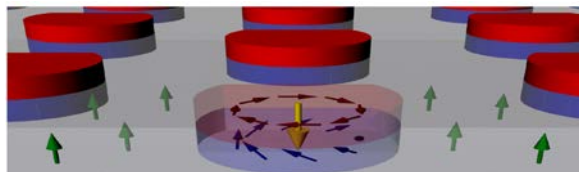
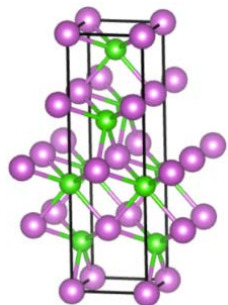
Eliminate additional support

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DMR Research Investments are Broad and Growing

New States of Matter



Skyrmions

CMP / K. Liu (UC-Davis)

Topological Insulators (CMMT, CMP, MRSEC)

New Materials Understanding

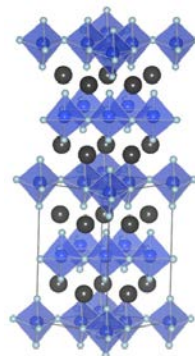


Calcium carbonate
made by the sea
urchin.

Reveals self-healing
mechanism.

BMAT/Gilbert; U. Wis.
Madison

New Materials



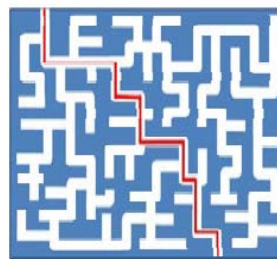
Newest blue pigment in
last 100yrs.

SSMC/Mas Subramanian
Oregon State

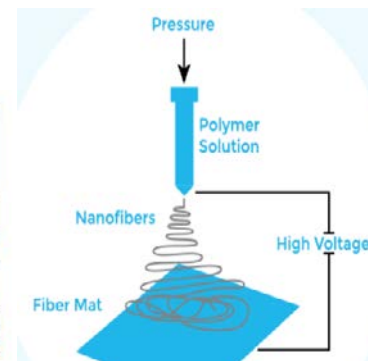


POL/Benjamin Hsiao Stony Brook Water Sustainability.

Conventional filter:
High-tortuosity
barrier layer



New filter concept:
Directed water channels
using cellulose nanofibers



Directed filter nanochannels increase water flux by >10 times!

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DMR-Supported MagLab Makes New World Record!



- ❑ **Strongest** magnet (36 T) in the world for NMR spectroscopy.
- ❑ **Decade** of planning, designing and building through DMR - *Mid-Scale Instrumentation Program* investments of \$14.8M.
- ❑ **Revolutionary Technology Development** - series connected hybrid magnet reaches very high magnetic fields which remain stable and homogeneous.
- ❑ **Boosted NMR sensitivity** for study of a wider range of elements.
- ❑ **“Opens a door of discovery”** making the highest magnetic fields available to not only physicists, but to chemists and biologists.

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National Facilities and Instrumentation (NaFI) Program

Stewardship: NaFI provides high cost and unique experimental capabilities to the DMR community:

- Cornell High Energy Synchrotron Source (CHESS) (\$10M/yr)
- National High Magnetic Field Laboratory (NHMFL) (\$32M/yr)

Partnership: National Facilities program partners:

- NIST: **The Center For High Resolution Neutron Scattering (CHRNS)** at the NIST Center for Neutron Research (\$2.8M/yr)
- NSF/CHE: **ChemMatCARS Beamline** at the Advanced Photon Source (\$0.3M/yr)
- NSF/ENG: **National Nanotechnology Coordinated Infrastructure (NNCI)** (\$2.5M/yr)



Started in 2016:

Materials Innovation Platforms (MIP)



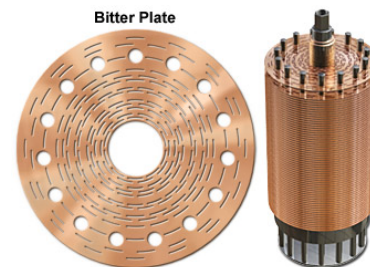
Tessema
Guebre



Leonard
Spinu



Charles
Ying



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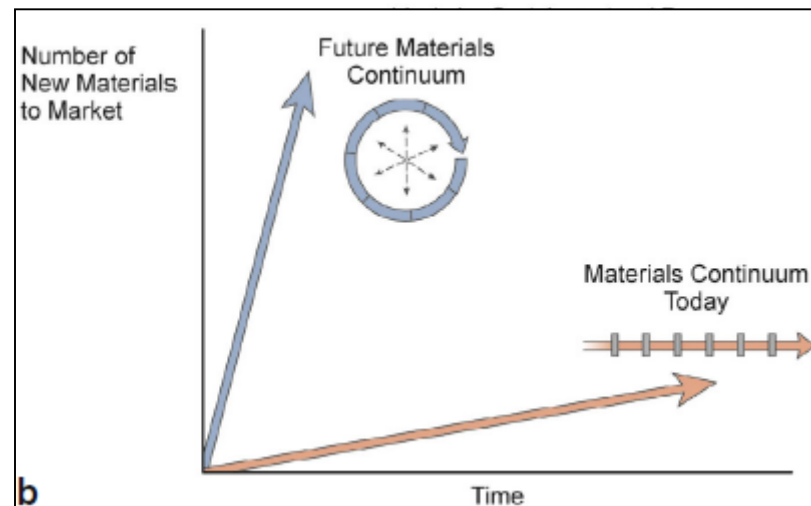
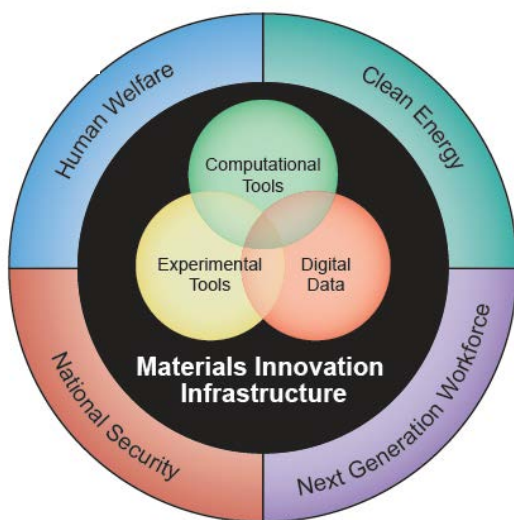
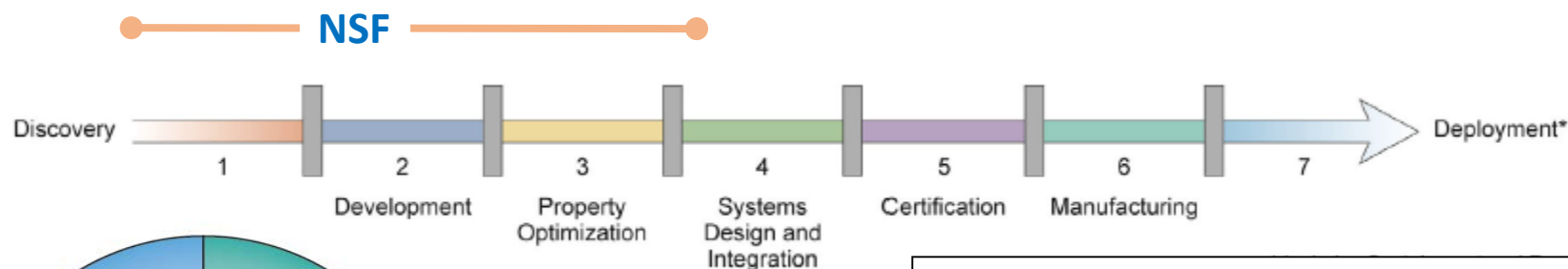


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Materials Genome Initiative (MGI) Approach

- **Integrate** and **Iterate** computational/theory - experimental - digital data information.
- **Decrease time of materials discovery to deployment.**



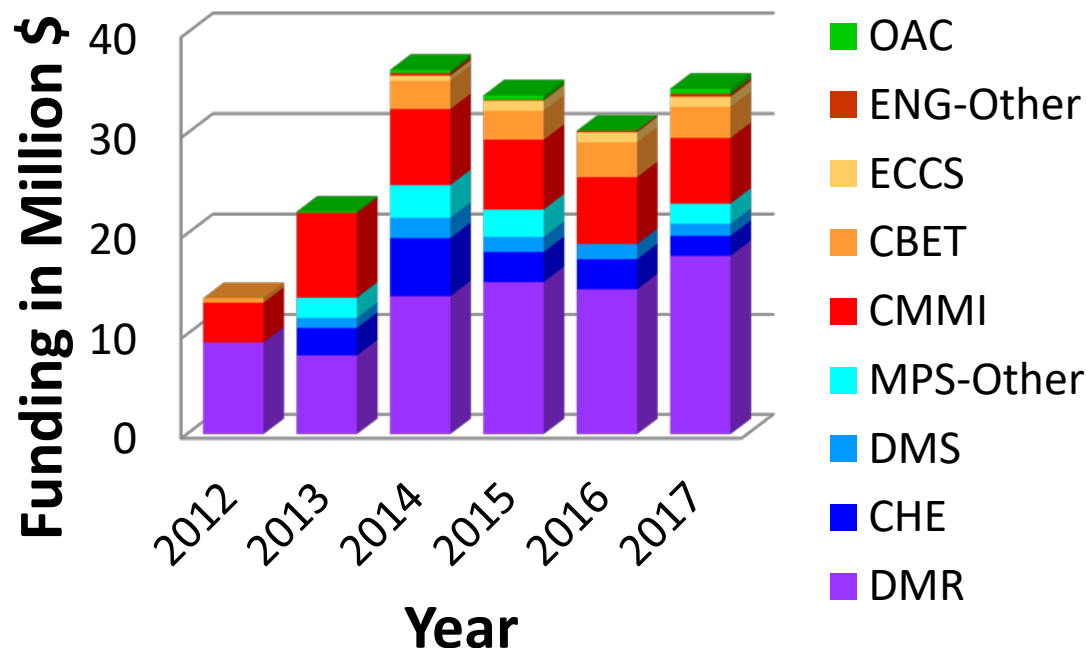
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Designing Materials to Revolutionize & Engineer our Future (DMREF)

\$16M DMR

- FY12: 14 awards, \$13.6 M
- FY13: 20 awards, \$22.2 M
- FY14: 29 awards, \$34.5 M
- FY15: 26 awards, \$33.9 M
- FY16: 24 awards, \$30.3 M
- FY17: 25 awards, \$34.4 M



Gone biennial, next competition, FY19



John
Schlueter



Eva
Campo

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2D Crystal Consortium

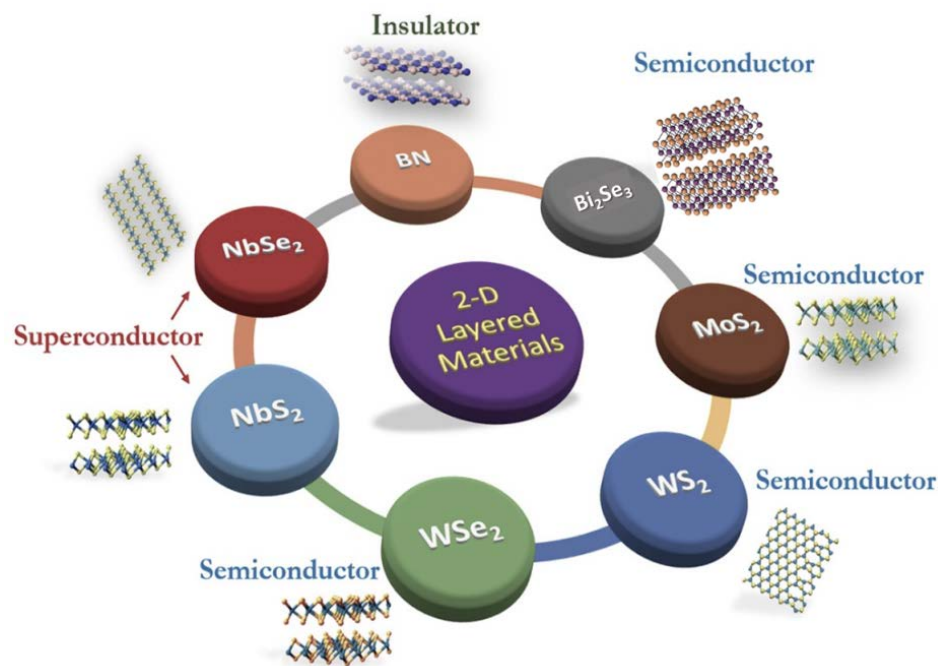
NSF Materials Innovation Platform



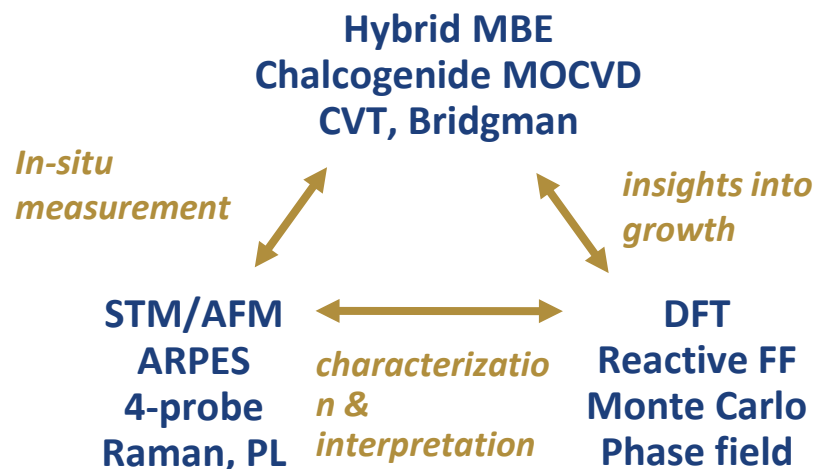
PennState



2D chalcogenide monolayers, surfaces and interfaces are emerging as a compelling class of systems with transformative new science that can be harnessed for novel device technologies in next-generation electronics.

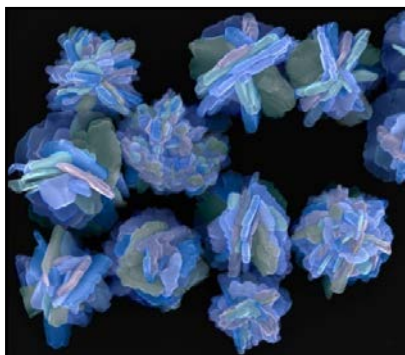


- Fundamental growth processes of 2D systems
- Conformal and uniform coverage of 2D systems
- Large area growth



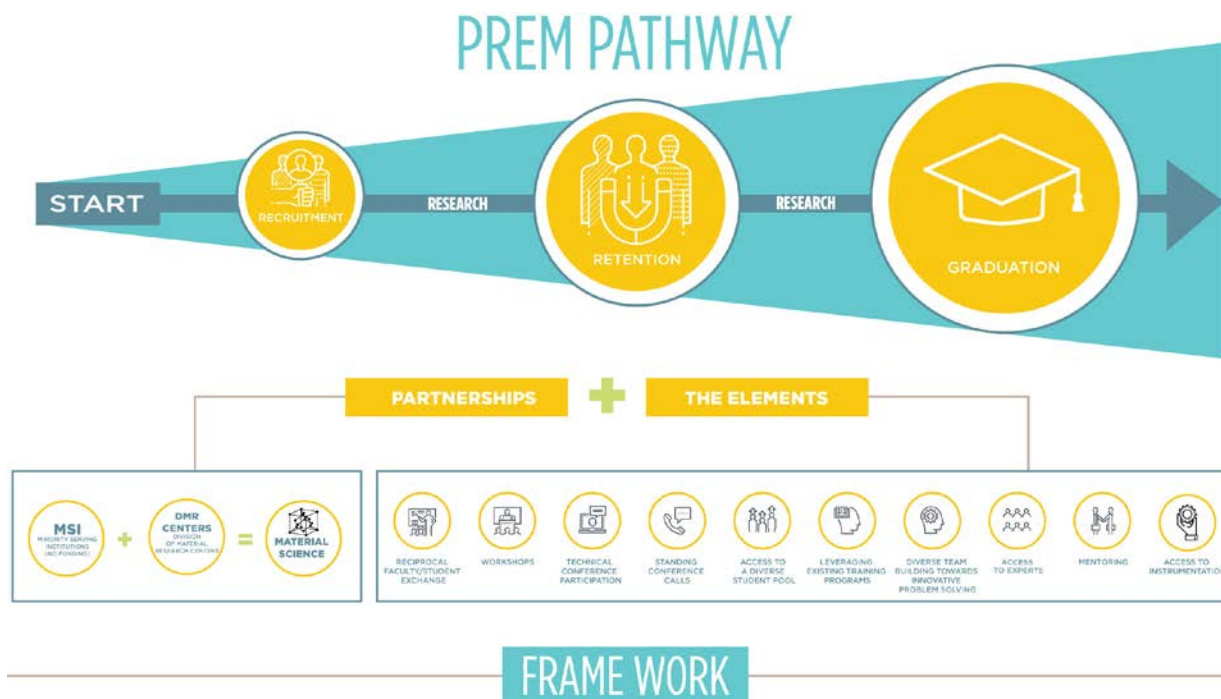
Find the 2DCC at www.mip.psu.edu

\$6M+



-PREM- Partnership for Research and Education in Materials Program

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



Eva
Campo

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THANK YOU!

lsapocha@nsf.gov

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*Materials Research Society Fall Meeting, Boston, MA
November 27- December 1, 2017*