Mathematical and Physical Sciences Advisory Committee (MPS AC)

F. Fleming Crim
Assistant Director
National Science Foundation
February 5, 2016

Supramolecular Chemistry ➞ Anion Sensor Application: Nitrate Content of Soils

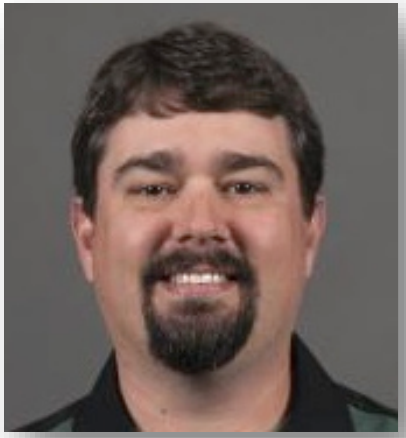
A Science Hors d'Oeuvre

Special thanks to Tim Patten, CHE

Basic Research: Supramolecules and Scaffolds

Supramolecular Main Group Coordination Chemistry

Darren Johnson

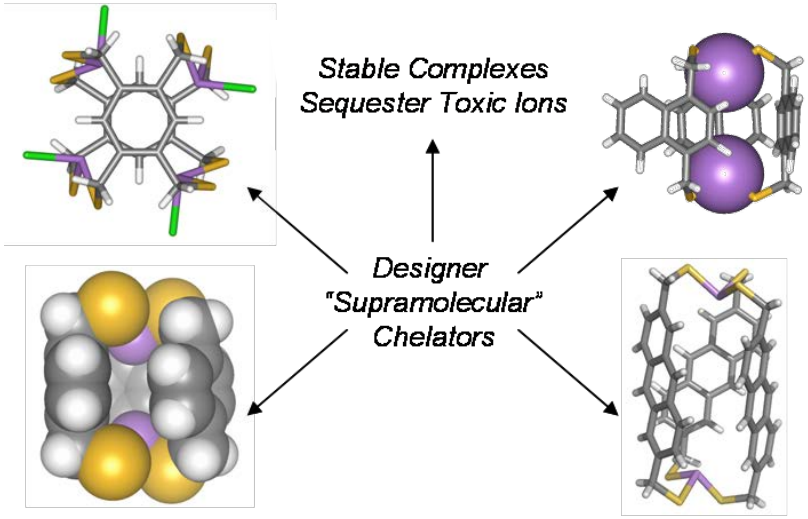


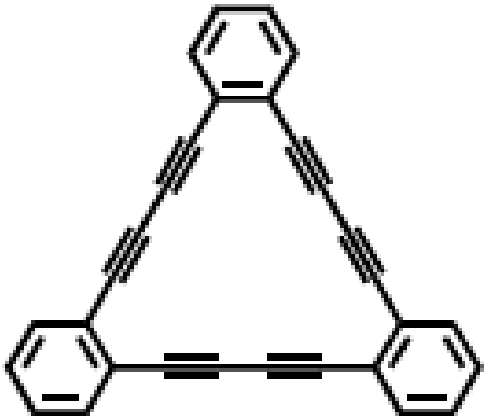
University of Oregon

Michael Haley

University of Oregon

Molecular Systems Built on Aryl-Acetylene Scaffolding: Experiment, Theory, and Materials Studies

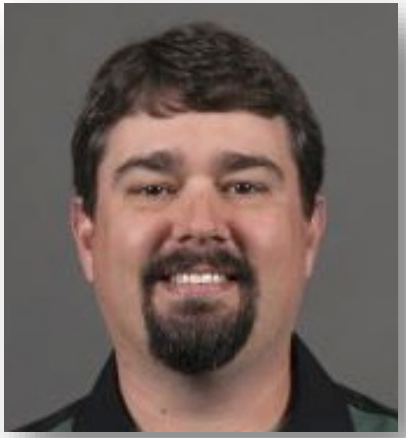




Basic Research: Supramolecules and Scaffolds

Supramolecular Main Group Coordination Chemistry

Darren Johnson



University of Oregon

Michael Haley

University of Oregon

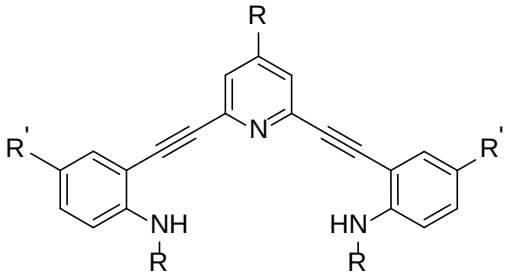
Molecular Systems Built on Aryl-Acetylene Scaffolding: Experiment, Theory, and Materials Studies

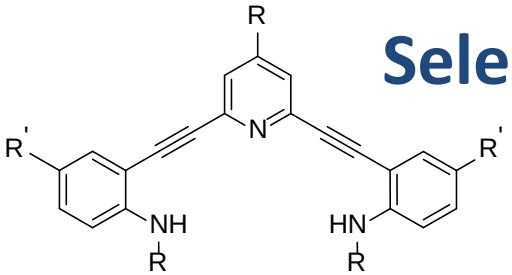
I-Corps: Commercialization of New Anion-Sensing Materials

Bind a species (anion) preferentially

AND

emit light

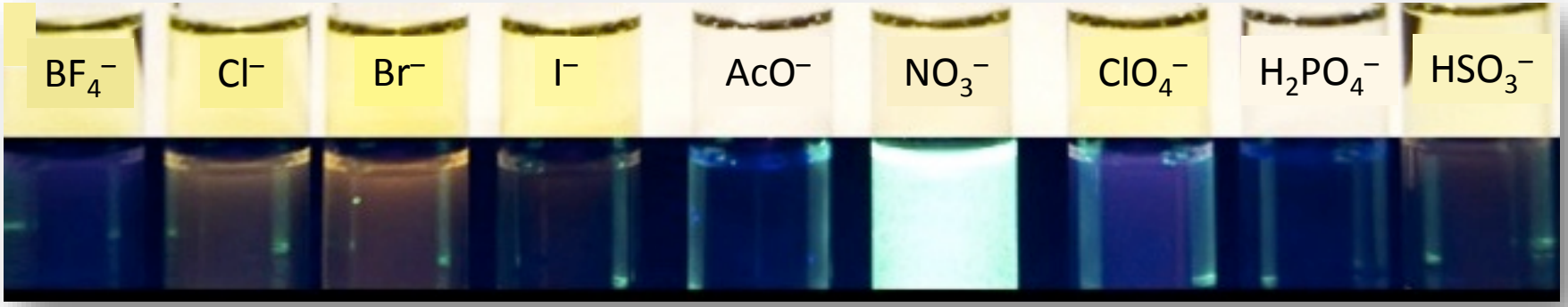




Selective Binding and Fluorescence

In solution

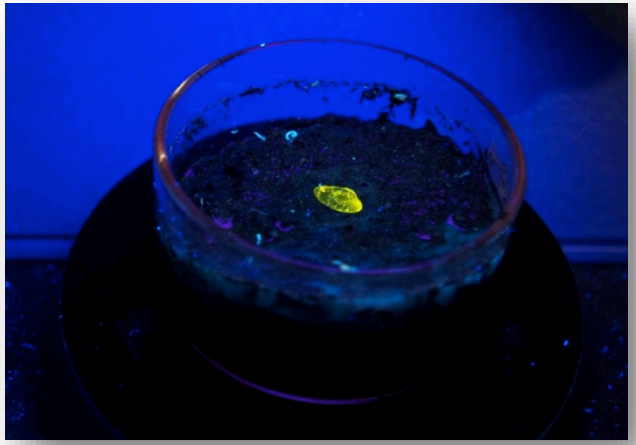
Ambient Light



Ultraviolet Light

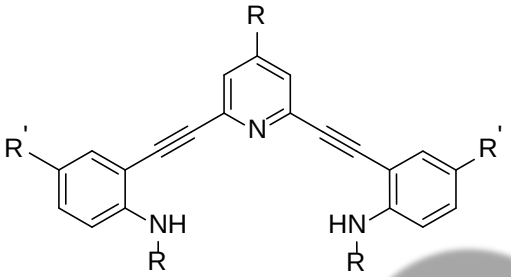
In a thin film

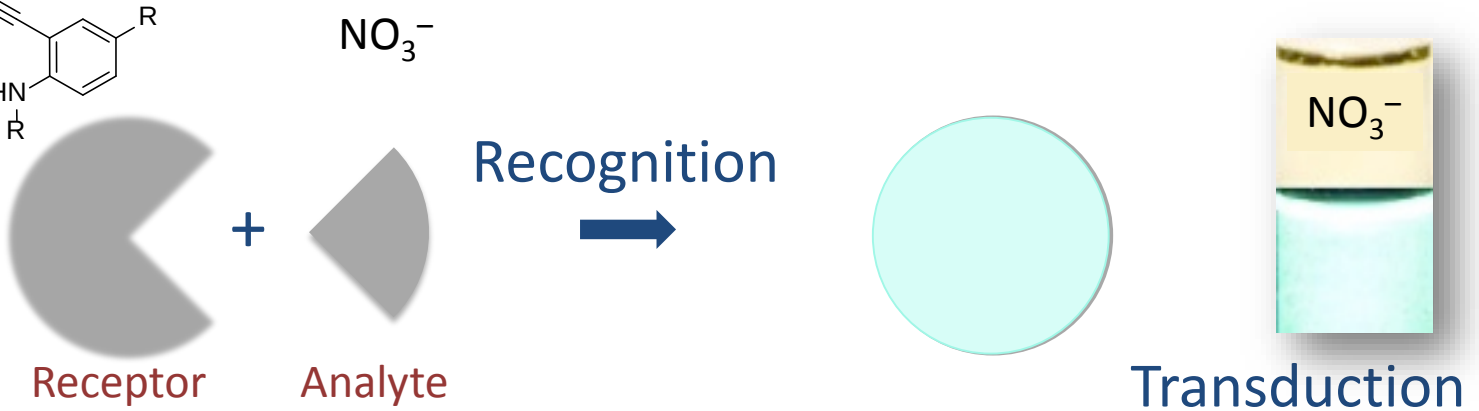
NO_3^-



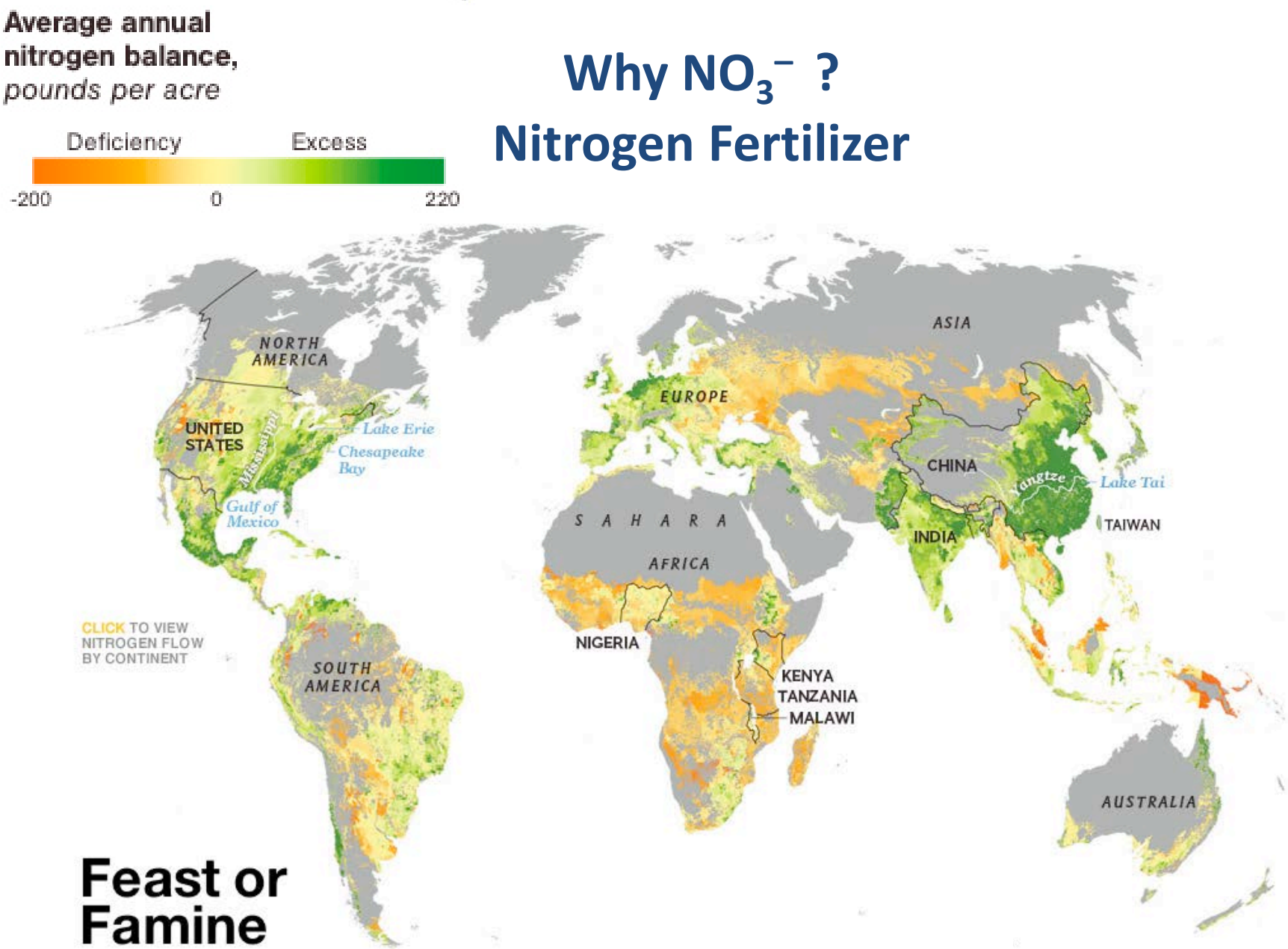
Application: Creating a Chemical Sensor

Common Chemical Sensors





Why NO_3^- ?
Nitrogen Fertilizer



(National Geographic attribution: "Fertilized World" by Dan Charles, May 2013)

New Company Founded in 2012

SupraSensor TECHNOLOGIES

Detect 1 ppm NO_3^- in 850 ppm Cl^-

Detection limit < 3 ppm

30 samples/hr (versus 10/day now)

1 g receptor makes 50,000 sensors

Science Nation Video from NSF

https://www.youtube.com/watch?v=Aitl_25S164&feature=youtu.be

Personnel and Plans

Budget

Facilities

Program Updates

Agenda

Office of the Assistant Director

Farewell and Thanks

Irma Johnson
Staff Assistant
(Detailee CHE)
Aug. 2015 – Dec. 2015

Farewell and Thanks

Greg Adams
Acting Directorate
Administrative Coordinator
(Detailee BIO)
May 2015 – Dec. 2015

Welcome (back)

Zita Barnett
Directorate
Administrative Coordinator

Office of the Assistant Director

Farewell and Thanks

Nathan McClain
Administrative Support Assistant

Farewell and Thanks

Eda Gimenez
Science Assistant

Farewell and Thanks

Keith Bennett
IT Specialist

Cliff Gabriel, Acting DAD

Mathematical and Physical Sciences (MPS)

Office of Multidisciplinary Activities (OMA)

Clark Cooper

Astronomical Sciences (AST)

Jim Ulvestad
DD

Chemistry (CHE)

Carol Bessel
Acting DD

Materials Research (DMR)

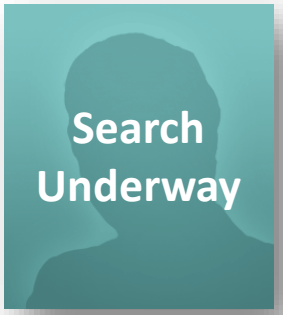
Linda Sapochak
Acting DD

Mathematical Sciences (DMS)

Michael Vogelius
DD

Physics (PHY)

Denise Caldwell
DD



Outstanding Leader

Mathematical and Physical Sciences (MPS)

Office of Multidisciplinary Activities (OMA)

Clark Cooper

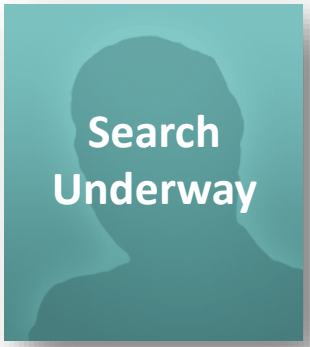
Astronomical Sciences (AST)

Jim Ulvestad DD

Chemistry (CHE)

Angela Wilson (March, 2016)

Materials Research (DMR)



Outstanding Materials Scientist

Mathematical Sciences (DMS)

Michael Vogelius DD

Physics (PHY)

Denise Caldwell DD

MPS Advisory Committee

Quarterly Meetings

(3 virtual, 1 at NSF)

In-person meeting
April 7 and 8, 2016

Personnel and Plans

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UNITED STATES
National Science Foundation

	FY 2015	FY 2016 (request)	
NSF	$ 7344M	$ 7724 M	5.2%
R&RA	$ 5934 M	$ 6186 M	4.2%

The New York Times

POLITICS

Congress Strikes a Budget Deal With President

By DAVID M. HERSZENHORN OCT. 26, 2015

FY 2016

BUDGET REQUEST TO CONGRESS

UNITED STATES
National Science Foundation

FY 2016

BUDGET REQUEST TO CONGRESS

MISSION: To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.

—From the National Science Foundation (NSF) Act of 1950 (P.L. 81-507)

VISION: A Nation that creates and exploits new concepts in science and engineering and provides global leadership in research and education.

—From "Investing in Science, Engineering, and Education for the Nation's Future" NSF Strategic Plan for 2014-2018

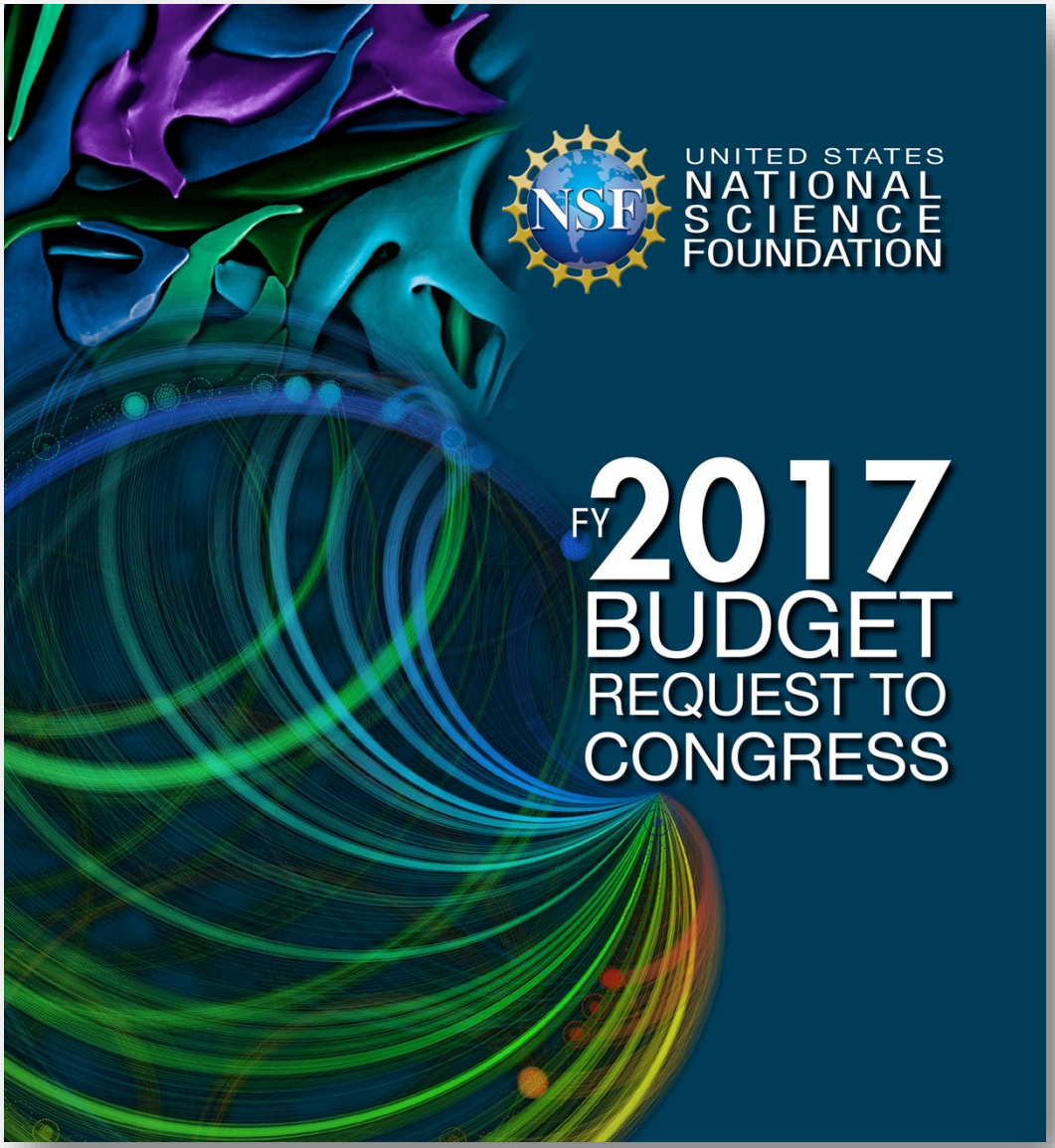
	FY 2015	FY 2016 (request)		FY 2016 (estimate)	
NSF	$ 7344M	$ 7724 M	5.2%	$ 7463 M	1.6%
R&RA	$ 5934 M	$ 6186 M	4.2%	$ 6034 M	1.7%

	Total	vs 2015 Actual	vs 2016 Request	Directorate Specific $
Authorization				
House	$ 7597 M	3.4%	–1.6%	Yes - explicit
Senate	–	–	–	–
Appropriation				
House	$ 7394 M	0.7%	–4.3%	Yes - implicit
Senate	$ 7344 M	0.0%	–4.9%	No
Omnibus	**$ 7463 M**	**1.6%**	**–3.4%**	**No**

Sausage Making
with Joseph Fasano*
or
with Congress

*https://upto.com/embedded/detail/4Ta5?pt=AwAO

Coming Attraction: Opening February 9



Personnel and Plans

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Two Facility Competitions Completed

National Radio Astronomy Observatory (NRAO)

ALMA

VLBA

✓ Award approved by the NSB (November)

Gemini Observatory

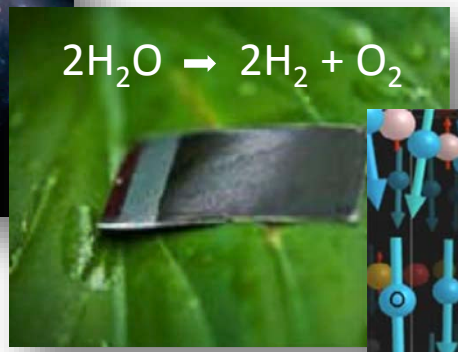
NOAO/AURA/NSF

✓ Award approved by the NSB (February)

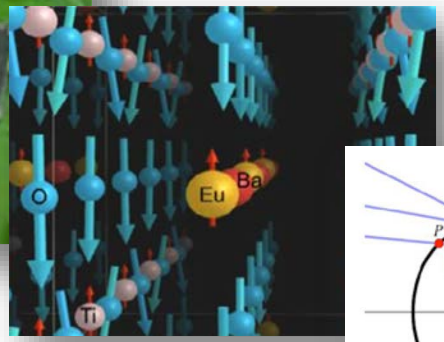
An Overview of Major Facilities Investments
Directorate for Mathematical and Physical Sciences

National Science Board

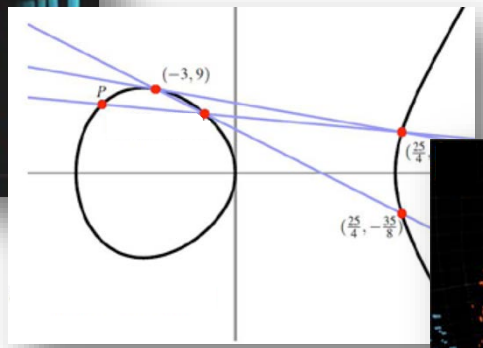
Astronomy



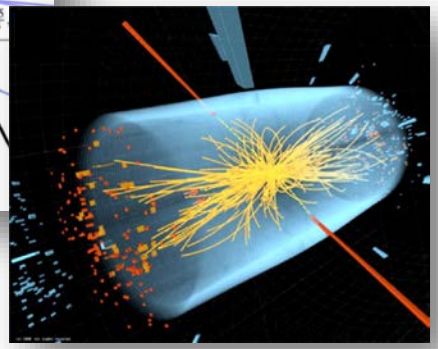
Chemistry



Materials



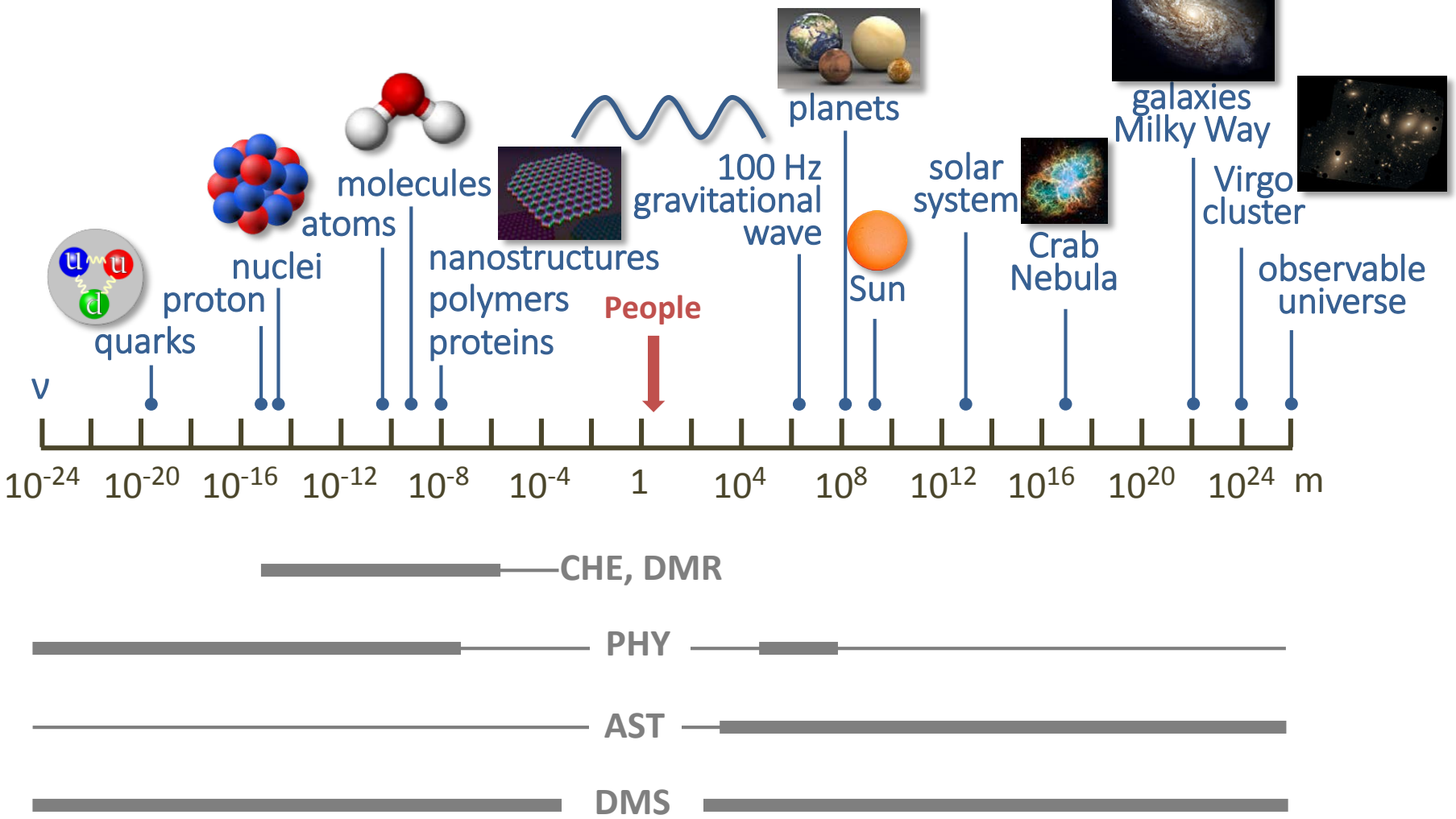
Mathematics



Physics

F. Fleming Crim
Assistant Director for Mathematical and Physical Sciences
February 2, 2016

Science at the Scales of the Universe

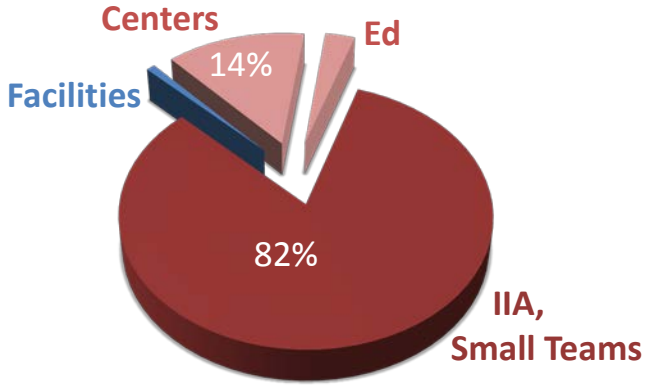


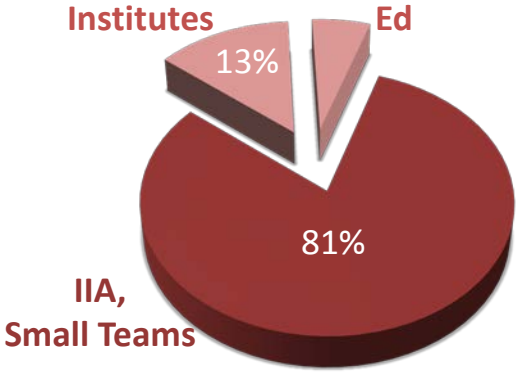
Images from Wikipedia Commons

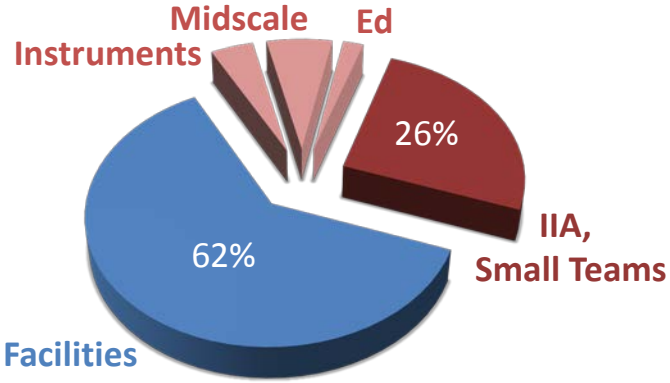
FY 2015

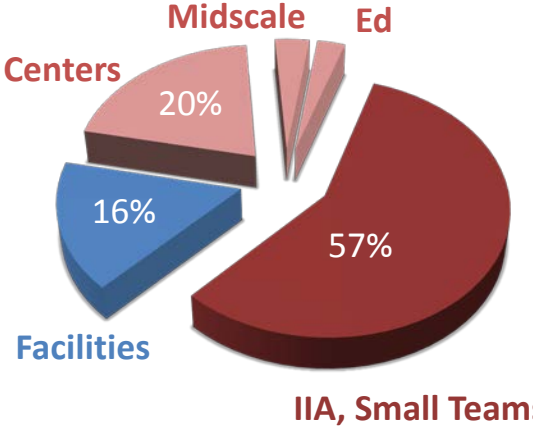
Mathematical and Physical Sciences (MPS)

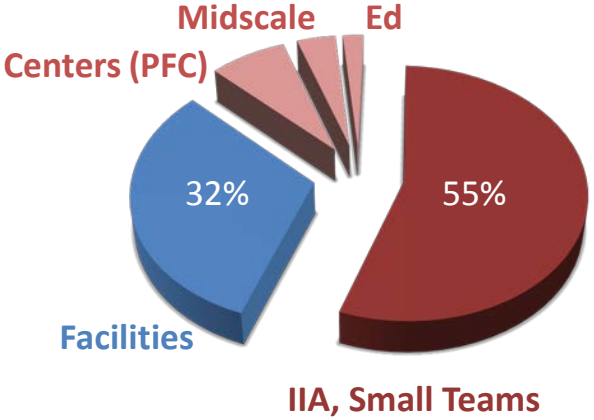
Astronomical Sciences (AST)	Chemistry (CHE)	Materials Research (DMR)	Mathematical Sciences (DMS)	Physics (PHY)
$ 244M	$ 244M	$ 307M	$ 232M	$ 275M

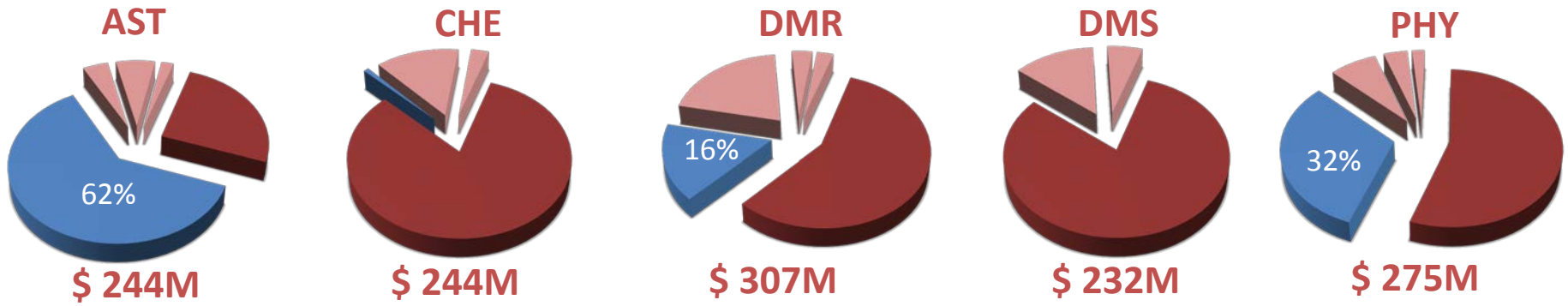


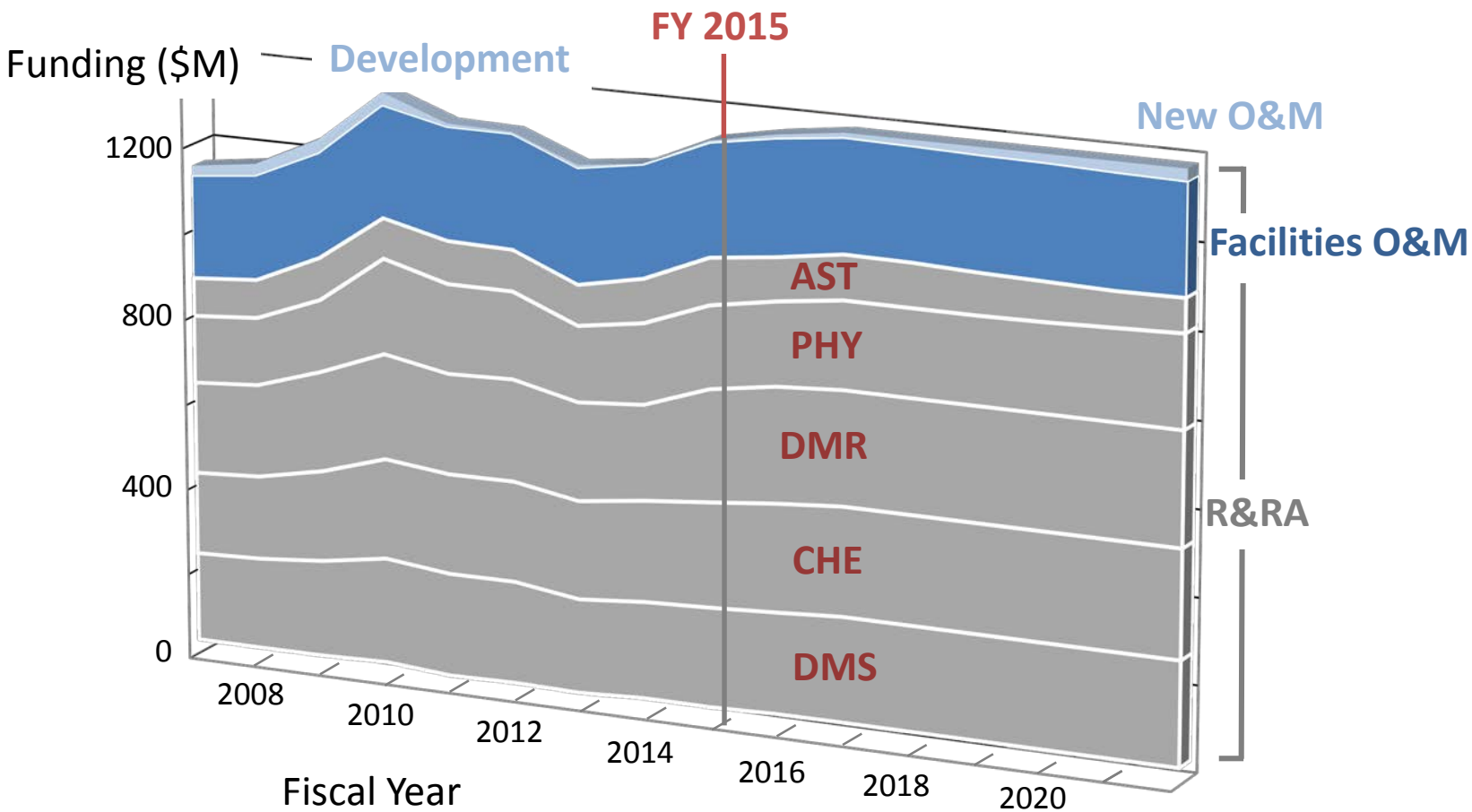




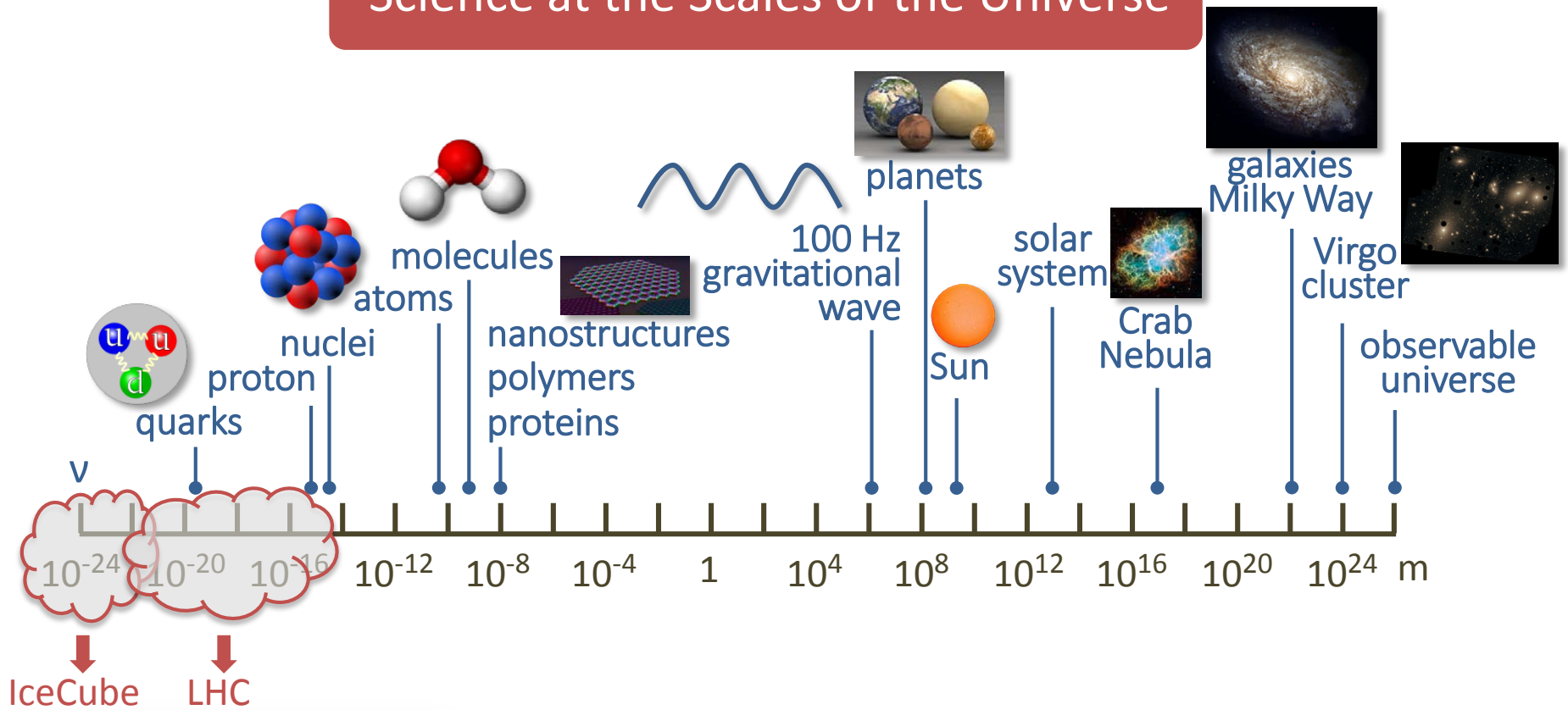


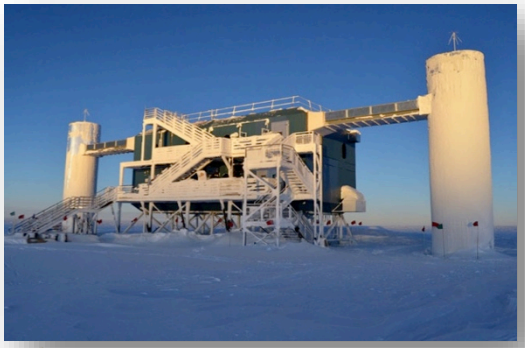


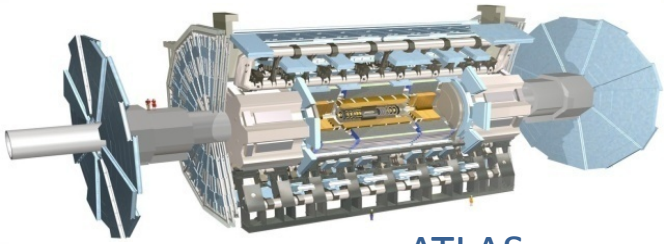

AST
62%
$ 244M
CHE
$ 244M
DMR
16%
$ 307M
DMS
$ 232M
PHY
32%
$ 275M

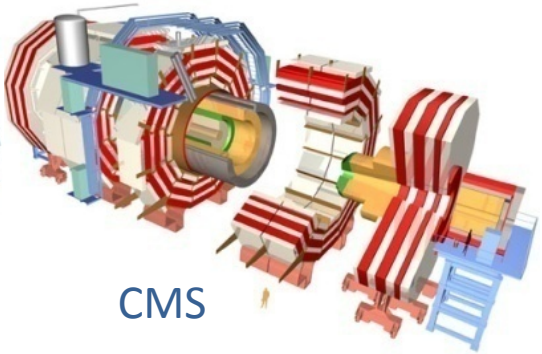

Funding ($M)
Development
FY 2015
New O&M
Facilities O&M
R&RA
AST
PHY
DMR
CHE
DMS
1200
800
400
0
2008
2010
2012
2014
2016
2018
2020
Fiscal Year

Science at the Scales of the Universe

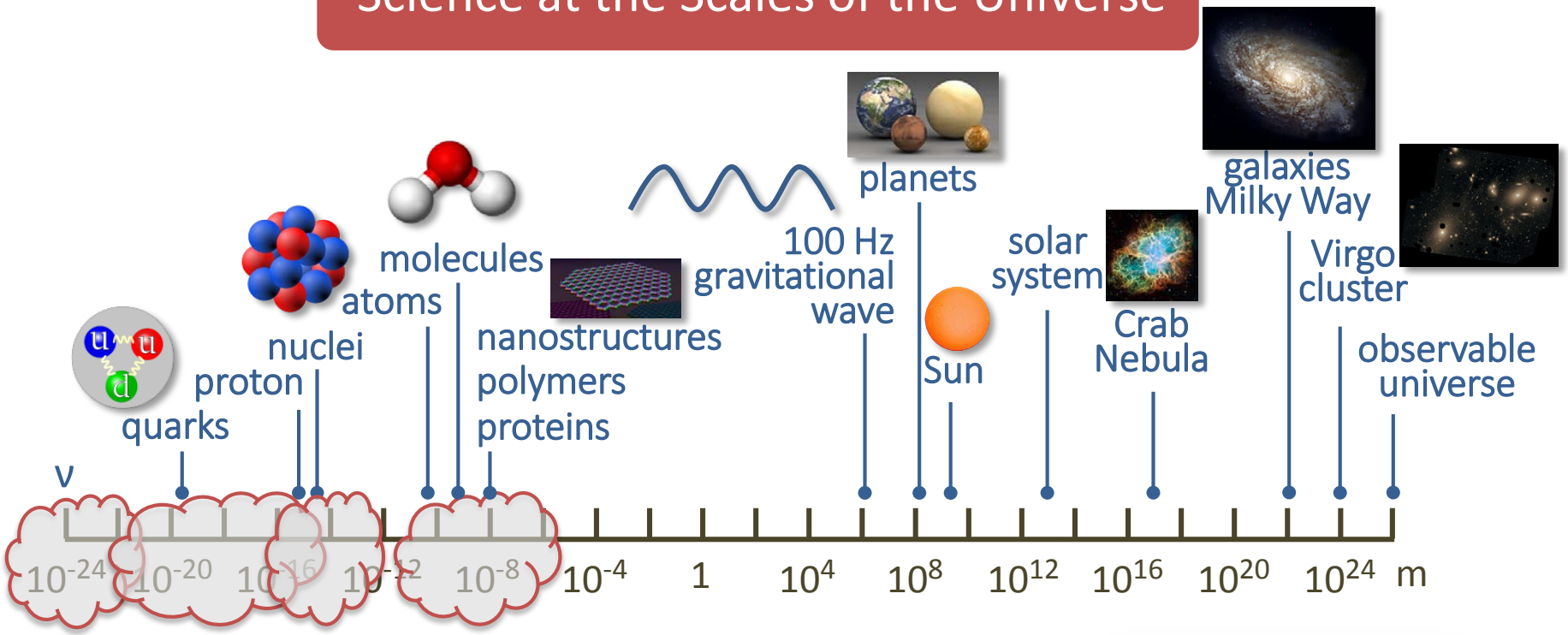




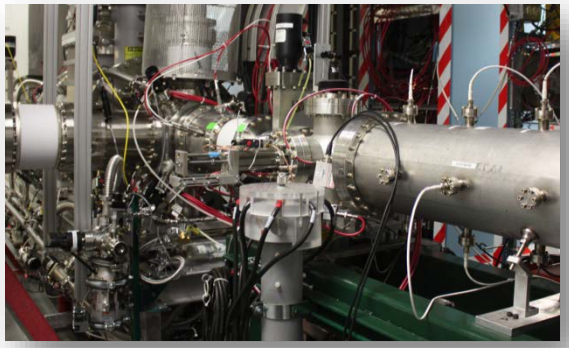




Science at the Scales of the Universe

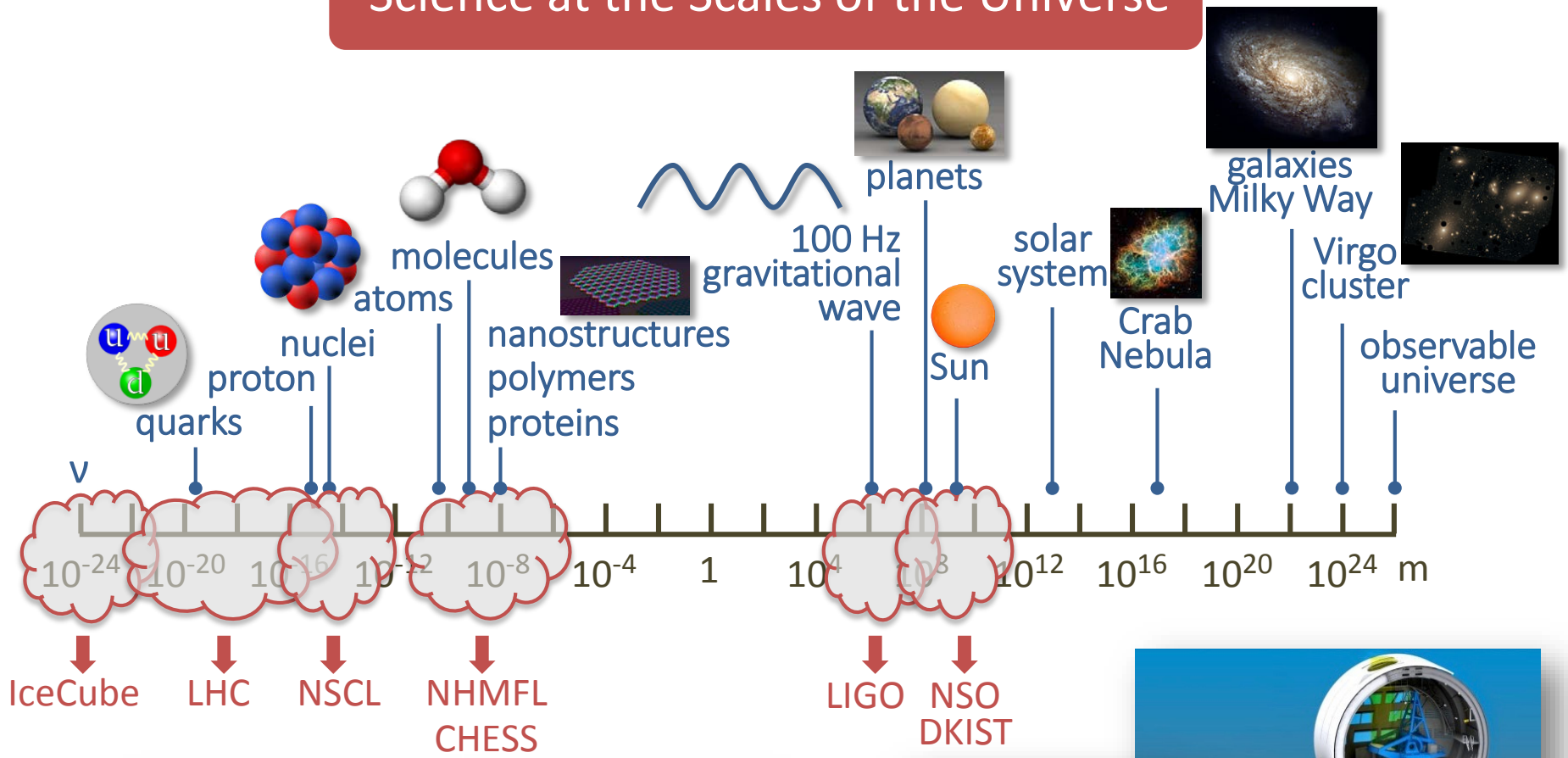


IceCube LHC NSCL NHMFL CHESS

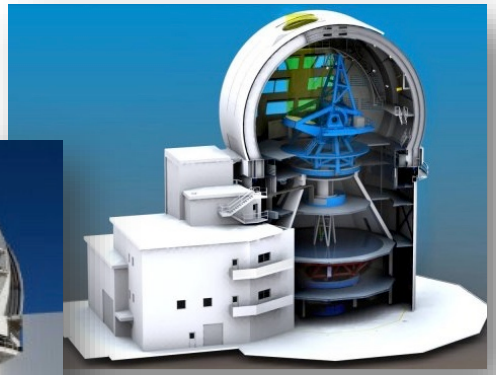


CHESS

Science at the Scales of the Universe



LIGO



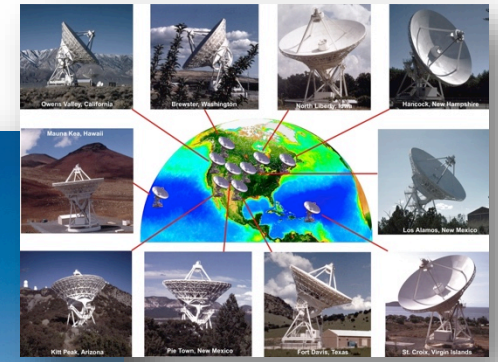
DKIST/AURA

Science at the Scales of the Universe

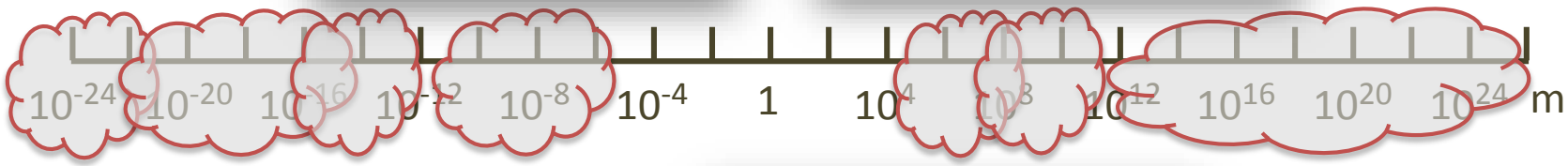
ALMA

NRAO/VLA

GBT



VLBA



IceCube

LHC

NSCL

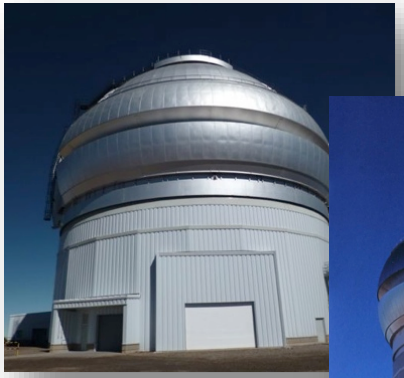
NHMFL
CHESS

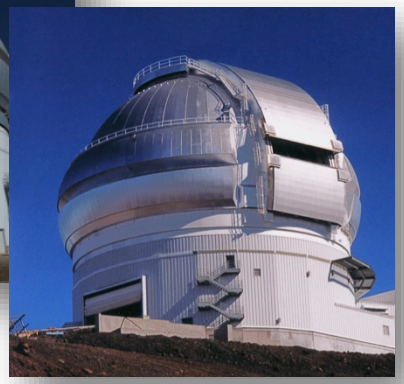
NAIC

NRAO
GBO
VLBA
Arecibo
NOAO
Gemini
LSST

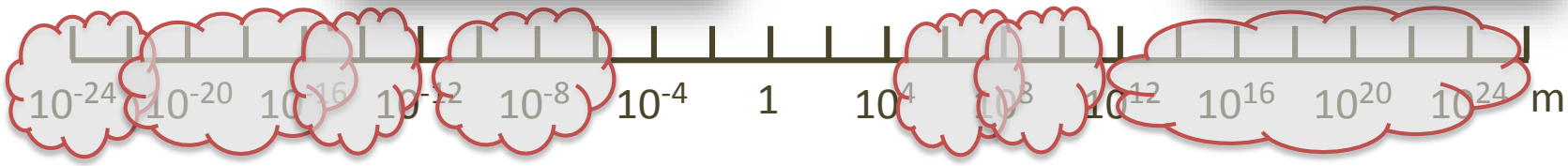
Science at the Scales of the Universe

NOAO/AURA





Gemini/AURA



IceCube

LHC

NSCL

NHMFL

CHESS

LIGO

NSO

DKIST

NRAO

GBO

VLBA

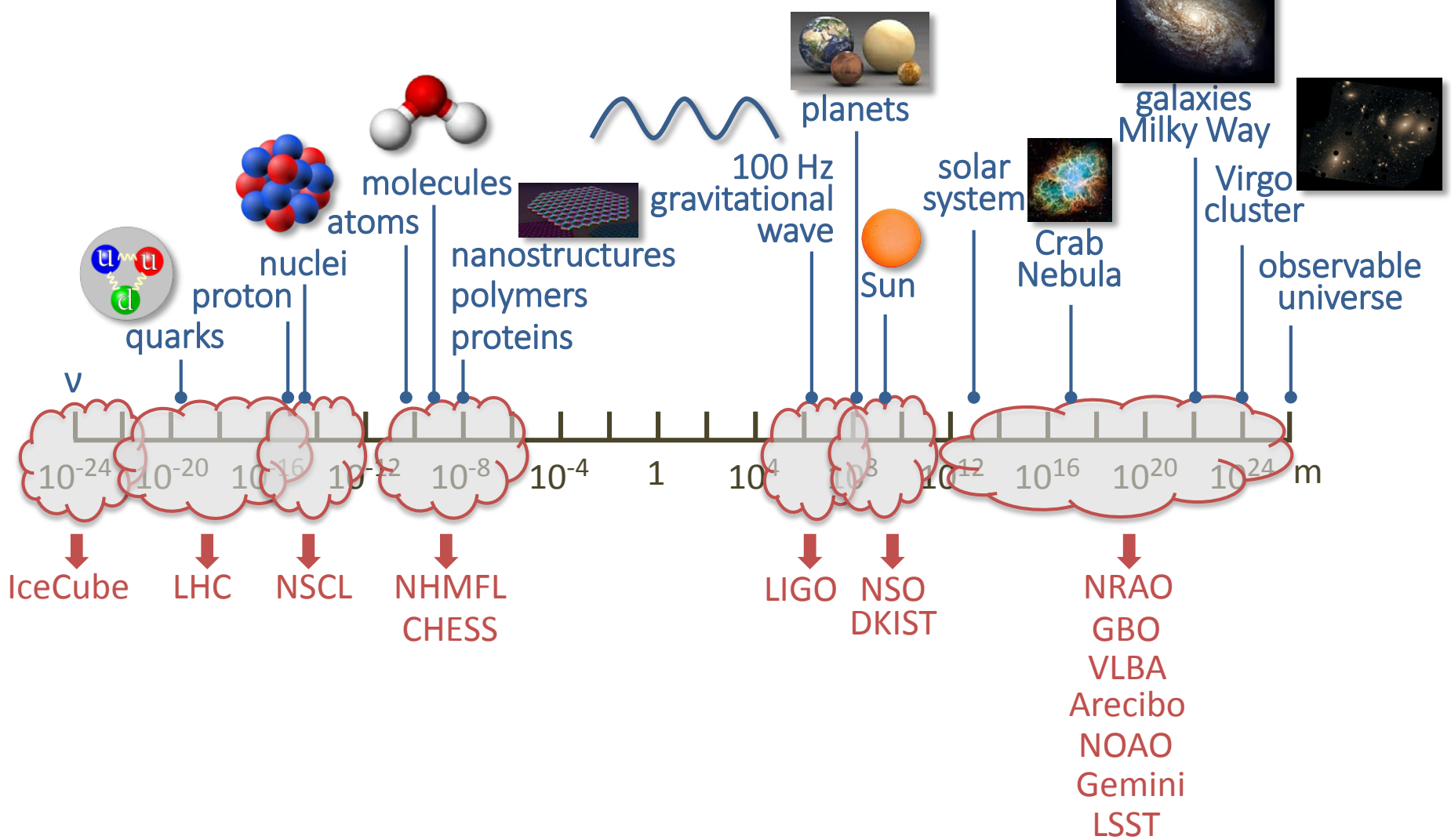
Arecibo

NOAO

Gemini

LSST

Science at the Scales of the Universe



Personnel and Plans

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National Medal of Science

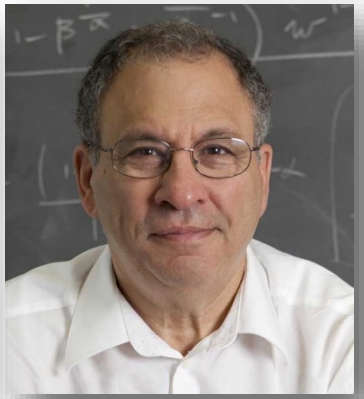
Alivisatos

DMR

Artin

DMS

Levin



DMS

Richmond

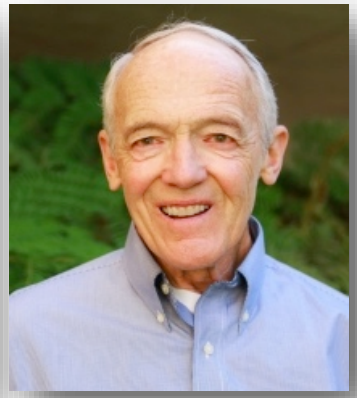
CHE

National Medal of Technology and Innovation

DeSimone

DMR/CHE

Gossard



DMR

A Few Updates on Activities and Issues

Committees of Visitors

Three this year: AST, DMR, PHY
DMS COV arrangements proceeding

Budget

Preparation of the FY 2016 Congressional Justification
Preparation of FY 2017 President's Request to Congress

Events

Dedication of Xenon1T – Gran Sasso
Signing of ALMA International Agreement - Tokyo

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Agenda

State of the Directorate ✓

National Center for Science and Engineering Statistics — 30
Emilda Rivers (NCSES)

Graduate Student Training — 60
Dean Eavsius (Director, Division for Graduate Education)
Nirmala Kannankutty (Deputy Director, DGE)

Break — 15

Early Career Investigators — 60

NSF Office of Legislative and Public Affairs — 60
Amanda Greenwell (Office Head OLPA)
Ivy Kupec (OLPA)

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