

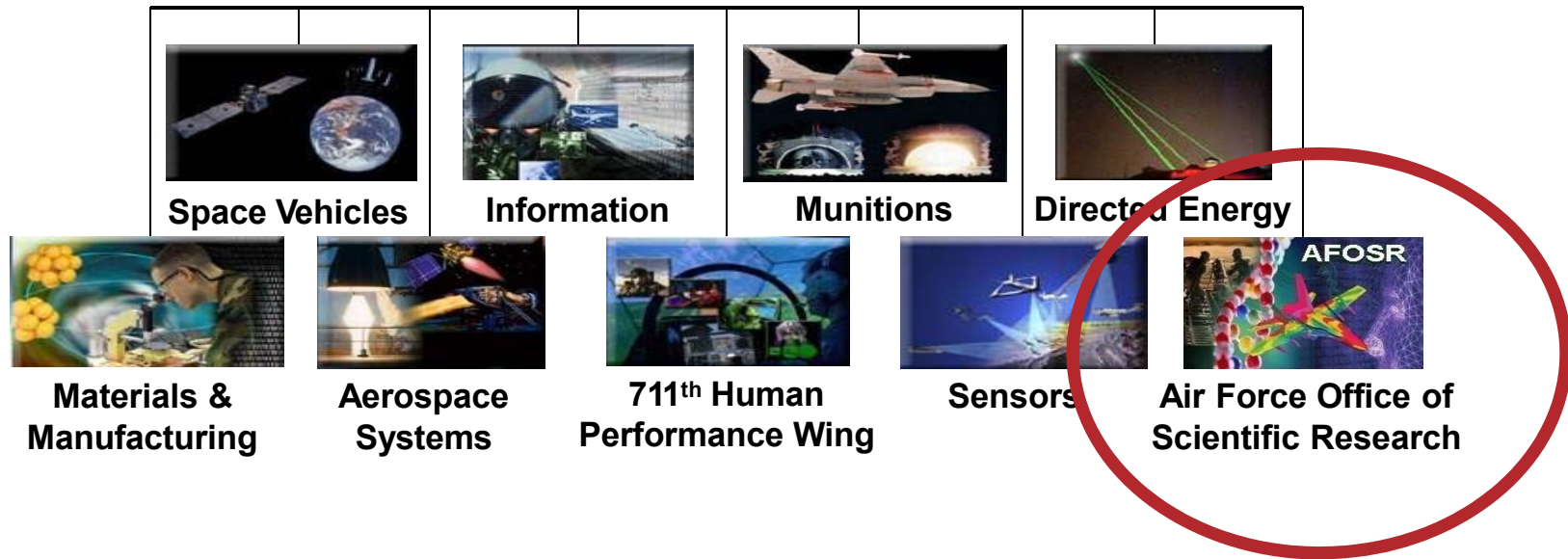


How to Work with AFOSR

Ali Sayir

AFOSR

Air Force Research Laboratory



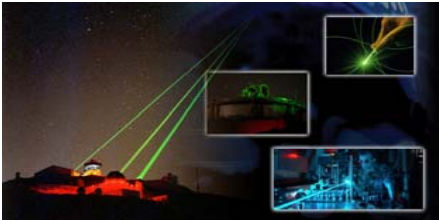
AFRL Top Priorities



Hypersonics



Autonomy



Directed Energy



Cyber

UNDERSTANDING AFOSR



Mission
Discover, shape, and champion **BASIC RESEARCH** that profoundly impacts the future Air Force

Annual Budget (~\$500M)



Category	Amount
Customer	~\$150M
Core	~\$350M

Air Force Universities Industry



5,880
Globally Active Grants



FY 2018 Global Science Investment
\$424.24M



Fiscal Years 2016-2018

**AFOSR
FACT
SHEET**

45
AFOSR
Research
Areas
Funded



48
Countries Receiving
Funding



2,367
Principal Investigators
Funded

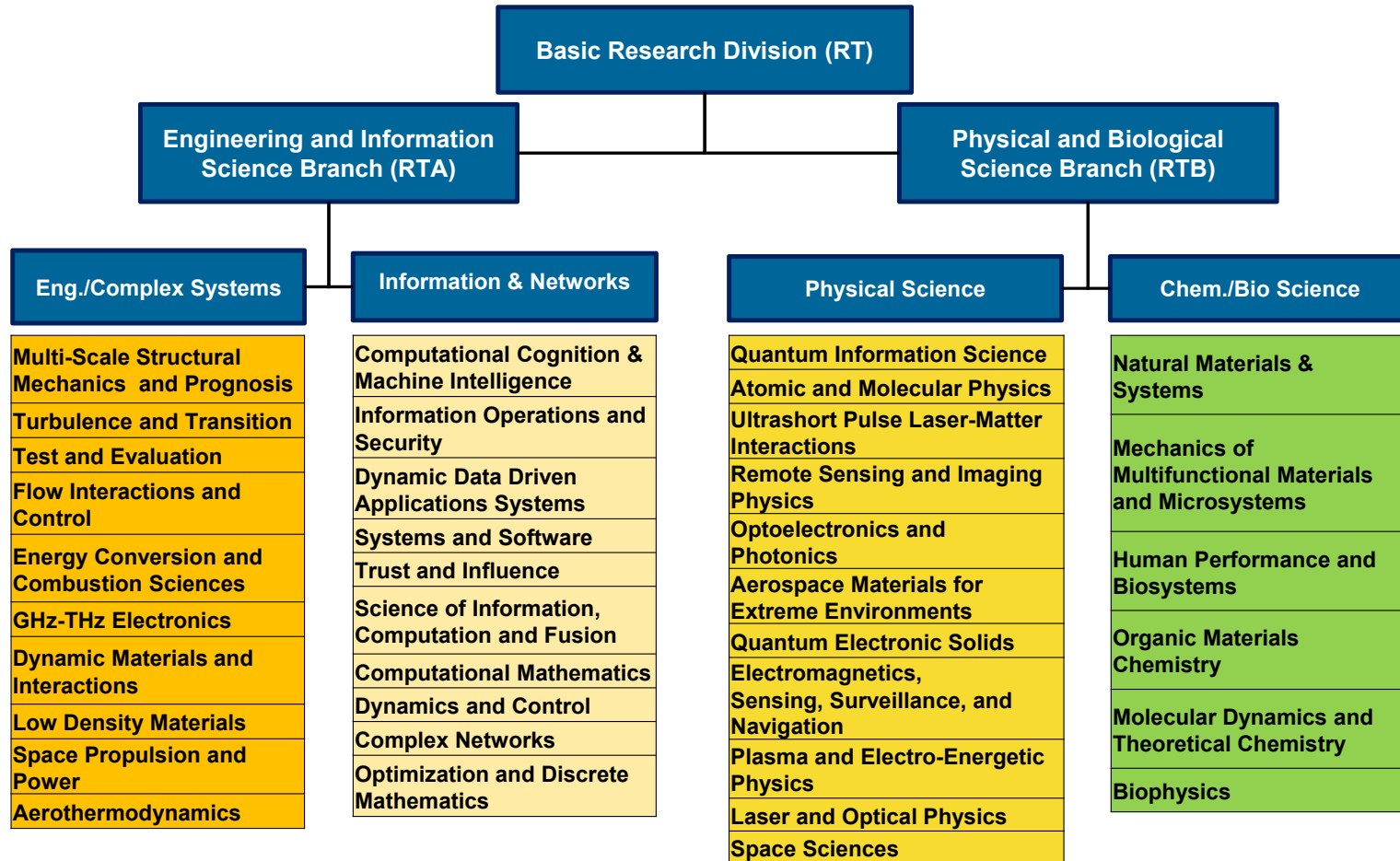
Our Mission

AFOSR continues to expand the horizon of scientific knowledge through its leadership and management of the Air Force's Basic Research program. As a vital component of AFRL, AFOSR's mission is to support Air Force goals of control and maximum utilization of air, space, and cyberspace. AFOSR accomplishes its mission by investing in basic research efforts for the Air Force in relevant scientific areas. Central to AFOSR's strategy is the transfer of the fruits of basic research to the academic community, directorates within AFRL, and industry.

196
U.S. Institutions
Funded

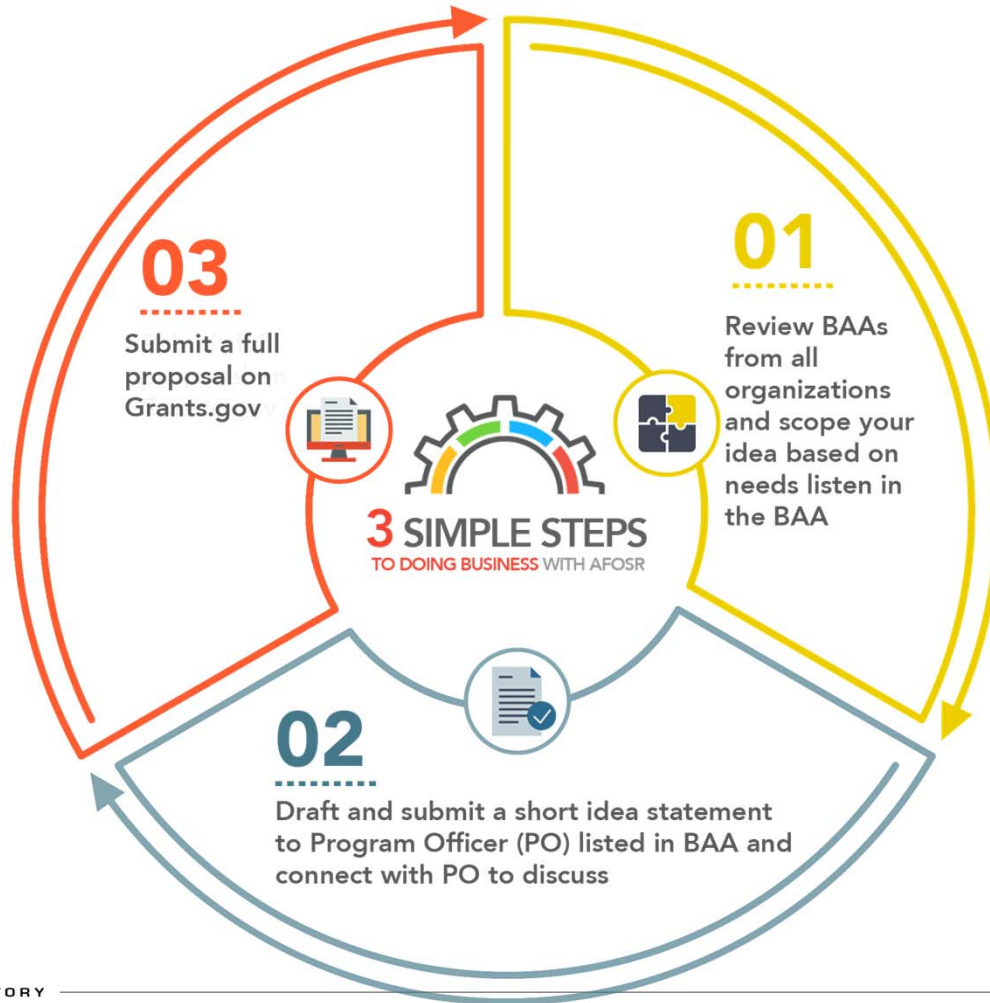


Portfolio Organization



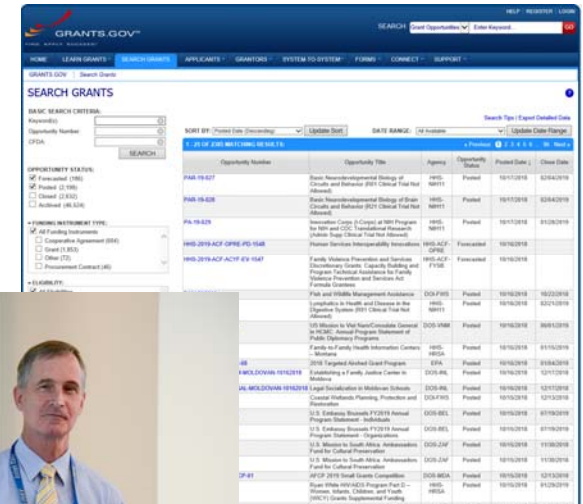
How to Work with AFOSR

ACADEMIA



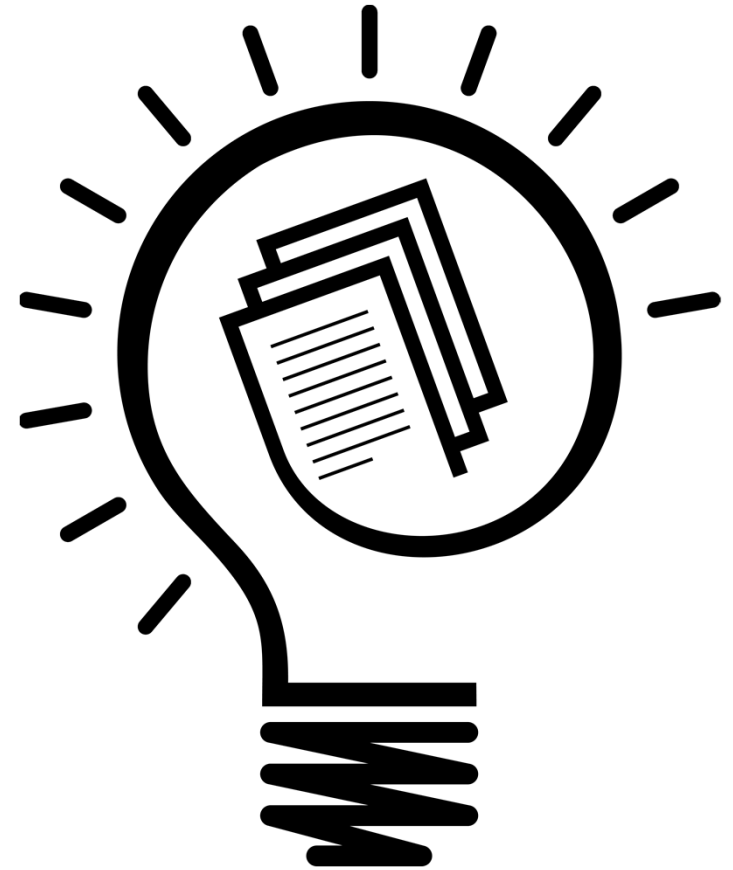
Review Broad Agency Announcements

- Researchers should visit www.grants.gov – the official source for finding and applying to Federal grants
- Find opportunities that match interests. Search by:
 - Keyword
 - Eligibility
 - Category
 - Agency etc.
- Study and keep current with BAAs
- Attend program reviews to understand the directions and needs of program



Scope and Draft Idea Statement

- Statement doesn't have to be all-inclusive, but should address the unique value proposition of the research
- Statement needs to be specific enough that it catches the interest of the Program Officer



Connect with Program Officer

- At this point, some Program Officers will want a specifically formatted white paper
- Others will want to have a conversation
 - In person
 - Over the phone
 - Via email
- If the idea seems promising, Program Officer will initiate an on going dialogue setting expectations and explaining the process for full proposal submission.

Program Manager Roles

- Topical / Program Expert
- Educator / Communicator
- Team Builder
- Advocate
- Evaluator
- Administrator
- Active Member of AFRL, DoD & Scientific Communities



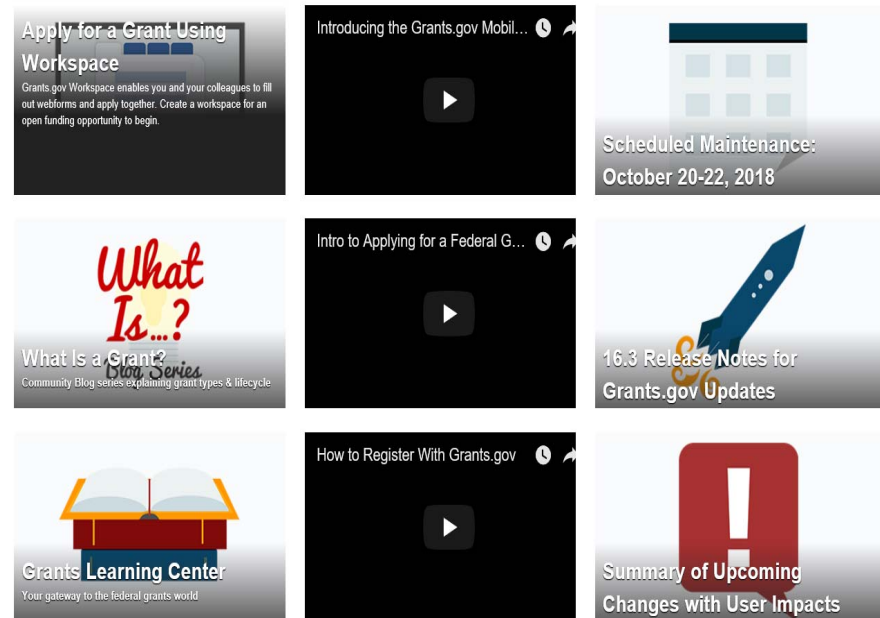
Program Officers' empowerment is a key component of our success

Determine the Correct Funding Mechanism

- There are a number of different mechanisms for universities to obtain basic research grant funding:
 - Traditional grants
 - University Research Initiatives (i.e. MURI, DURIP)
 - Special Programs (i.e. HBCU/MI, YIP)
- Traditional grants can be awarded year round from the general BAA
- Other opportunities have specific deadlines

Submit Full Proposal

- Full proposals should include
 - Strong technical merit
 - AF relevance
 - Solid budget justifications
- Full details can be found in the BAA
- Grants.gov also provides a number of tutorials for using the site



Peer Review

TECHNICAL:

Proposal subject area is appropriately addressed in the AFOSR BAA.

- What will be the results of this work and how novel are they? :
- How will the results advance the state of the art and how significant will the advancement be? :
- Will the proposed approach produce the desired results? What are its strengths and weaknesses? :
- Comment on the key personnel's qualifications, capabilities, related experience, and past performance. :
- Additional comments and relevant issues?:

RELEVANCE & RELATION OF AF:

OTHER CRITERIA:

- Comment of the adequacy and/or availability of the facilities, equipment, hardware, simulation tools and techniques integral to the objectives of the proposed research. :
- Comment on the realism and reasonableness of the proposed project cost. :

IS THERE AN ASPECT OF THE PROPOSED RESEARCH THAT WILL LEAD TO A SIGNIFICANT TRANSFORMATION IN OUR UNDERSTANDING OF THE STATE-OF-THE-ART? IF SO, PLEASE BRIEFLY DESCRIBE THE TRANSFORMATIONAL ASPECT OF THE WORK.

Budget Justification

- **For Personnel Management:**
Discuss realism and reasonableness of the (a) number of personnel, (b) labor mix, (c) level of effort etc.
- **For Permanent Equipment (>\$5,000/unit and useful life > 1 year)**
Are all the permanent equipment items special purpose and/or test equipment, interconnected and interdependent, reasonable and acceptable for the work to be performed and of significant value to the project.
- **Consumables and facility Chargers:**
Provide JUSTIFICATION and explanation with respect to proposed research. Provide quotations and/or links to the price structure of consumables, materials supplies, and facility charges.
- **Other Direct Costs**
Provide Justification for direct costs
- **Travel:**
For travel or quantity of trips, (a) rationale for travel, (b) the amount of travel or quantity of trips, and (a) the number of personnel traveling in terms of realism and reasonableness for the work
- **Subcontract:**
Discuss (a) rationale for these costs, (b) why it is necessary, (c) what does it add to the research, and (d) why can it not be accomplished by the awardee/grantee.

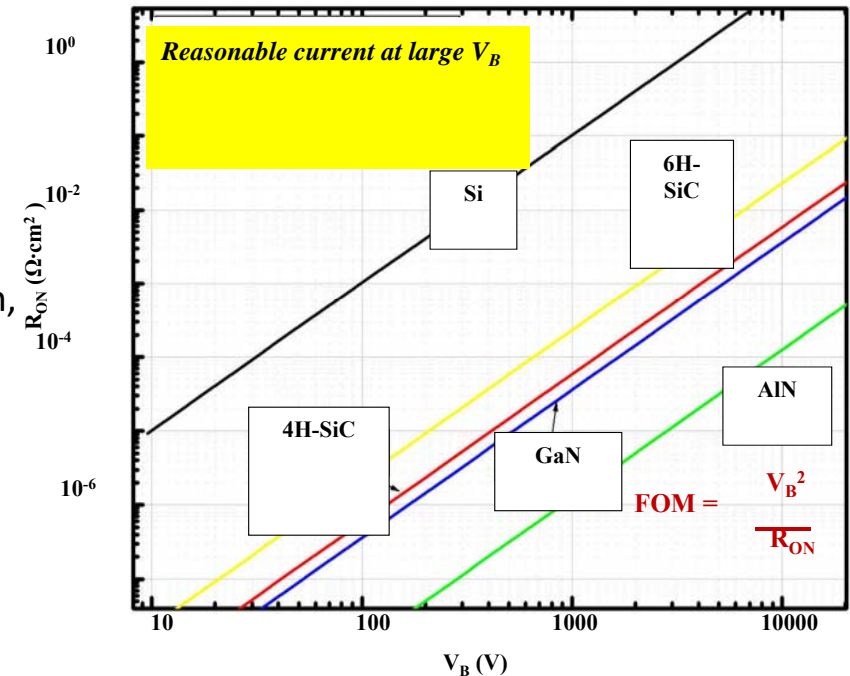
Get Funded! Get started and stay involved

- POs weigh several factors in selecting proposals for funding:
 - Identify overlap with program interests, and connecting to DODS labs
 - Potential for scientific breakthroughs
 - Strategic directions
 - Budget realities
 - Peer review to gauge scientific merit
- Once funded, remain engaged and continue with the process.
 - Continue reviewing BAAs
 - Attend program reviews
 - Collaborate with other PIs in the program

GHz ELECTRONICS AND MATERIALS

PM: Ken Goretta

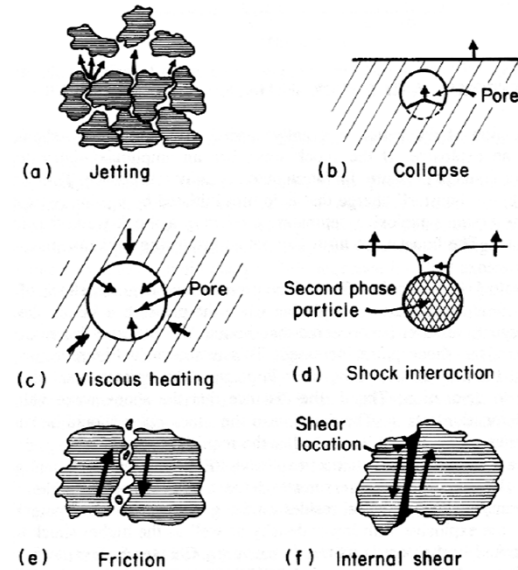
- UWBGs: synthesis, alloying, doping, heterostructures (including 2-D electron and hole gases), defects, thermal management, electrical contacts, characterization, modeling/theory
- Oxides: materials systems, synthesis, heterostructures, defects (especially interfaces), structure/property relations, theory
- 2-D materials/heterostructures: defects, interfaces, 2-D/3-D integration, electrical contacts, emerging physics, device design and fabrication
- Reconfigurable devices (mostly physical reconfiguration): materials, mechanics, actuation control, theory and design, performance
- THz speeds / materials for quantum systems: fundamental physics and control thereof, design, nanofabrication
- **Balance classical superconductivity & quantum information science investments**
- Sensors/detectors: identifying the most promising basic research directions (AFRL workshop in Spring 2019)



DYNAMICS MATERIALS AND INTERACTIONS

PM: Martin Schmidt

- Lack of predictive understanding requires long development times and large resource investment for new explosive formulations
- Dynamic response of heterogeneous materials is complex and continuum response depends on the stochastic mesostructure
 - How do you bridge the multiple length and time scales involved
 - How do you account for material heterogeneity at the continuum
- Mesoscale validation experiments are extremely challenging but critical to code validation and model development
- How to realize the promise of increased energy density from reactive materials



MULTISCALE STRUCTURAL MODELING AND PROGNOSIS

PM: Jay Tiley

- Need to integrate different mechanics models across multiple length scales (crystal plasticity modeling, characterization tools for verification, quantifying uncertainty... **when is good enough?**)
- Need for coupling physics based models to address hypersonic air flow interactions with compliant structures (thermal, acoustic, and mechanical models... **what is truly important to capture behavior?**)
- Need for high velocity data sets for verification of damage models and mechanical behavior across entire flight regimes (need for accurate structural load data... **why do structures fail?**)
- Need for new aerospace design paradigms (structural optimization, novel configurations... **how can we improve capabilities?**)



Dramatic stiffness change with simple actuation mechanism through structural locking of origami

ORGANIC MATERIALS CHEMISTRY

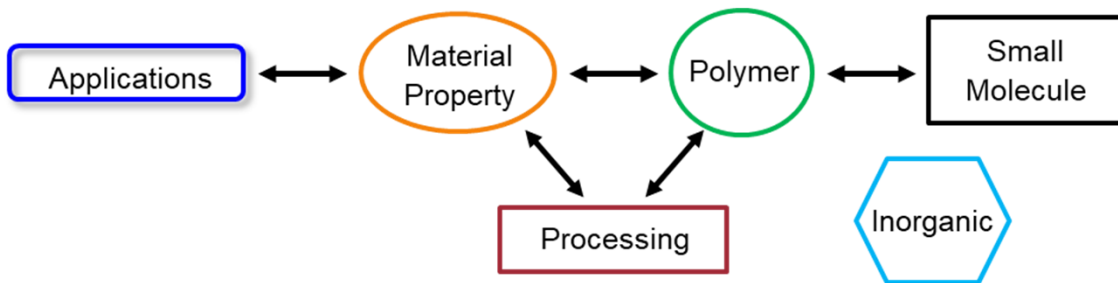
PM: Ken Caster

RESEARCH AREAS

- Photonic Materials
- Electronic Materials
- Novel Properties
- Nanoscience

SCIENTIFIC DRIVERS

- Fundamentals → understanding
 - Precise control: composition, connectivity, structure, morphology, topology, self-assembly, length scale, structure/property
 - Design rules: catalysts, material properties, conversion/selectivity
 - On-demand: enabling chemistry, materials, tunable properties
 - Characterization: full analysis, new methods
 - Computational models and simulations: new, faster/more accurate
 - Interdisciplinary approaches



AEROSPACE MATERIALS FOR EXTREME ENVIRONMENTS

PM: Ali Sayir

RESEARCH AREAS :

I. Predictive Materials Science

- Synthesis science
- Supersaturated lattice

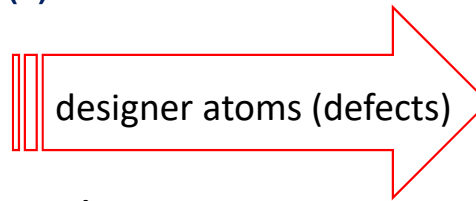
II. Electromagnetic Coupling with Structure of Material

- Metal-Dielectric Interface
- $\beta\text{-Ga}_2\text{O}_3$
- Beamed Energy: mm – wave

III. Hypersonic Materials

AREAS OF EMPHASIS:

(1) Quantum Materials:



1. Entanglement distribution
2. Highly entangled states (graph states)

Requirements:

- picometer resolution
- validating ultra-fast time dynamics

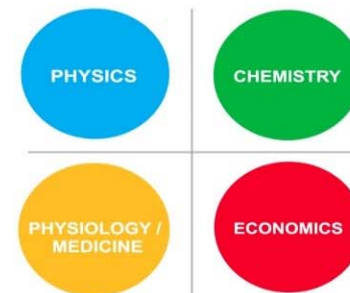
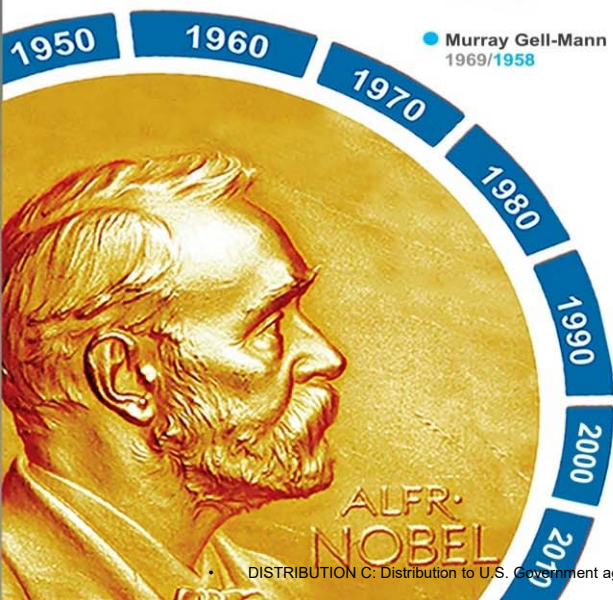
Metric:

- the design of tunable elements and defects
- ability to tune continuously the fundamental Coulomb interactions, and carrier hopping
- magnetic interactions that govern correlated behavior.

(2) Science of Rare Events:

78 AFOSR SUPPORTED NOBEL PRIZE LAUREATES

1950	1960	1970	1980	1990	2000	2010	
<ul style="list-style-type: none"> ● Polykarp Kusch 1955/1954 ● Willis Lamb 1955/1954 ● John Bardeen 1956/1953 	<ul style="list-style-type: none"> ● Willard Libby 1960/1951 ● Robert Hofstadter 1961/1953 ● Eugene Wigner 1963/1958 ● Charles Townes 1964/1953 ● Robert Mulliken 1966/1952 ● Hans A. Bethe 1967/1953 ● Ragnar Granit 1967/1959 ● George Porter 1967/1962 ● Lars Onsager 1968/1966 ● Murray Gell-Mann 1969/1958 	<ul style="list-style-type: none"> ● Ulf Von Euler 1970/1959 ● John Bardeen 1972/1953 ● John R. Schrieffer 1972/1959 ● Nikolaas Tinbergen 1973/1961 ● Brian Josephson 1973/1968 ● Paul Flory 1974/1961 ● William Lipscomb 1976/1959 ● Phillip Anderson 1977/1968 ● John Van Vleck 1977/1964 ● Llya Prigogine 1977/1954 ● Herbert Simon 1978/1962 ● Sheldon Glashow 1979/1958 ● Abdus Salam 1979/1962 ● Steven Weinberg 1979/1958 	<ul style="list-style-type: none"> ● Walter Gilbert 1980/1959 ● Nicolaas Bloembergen 1981/1975 ● Kai Seigbahn 1981/1956 ● Arthur Schawlow 1981/1981 ● David Hubel 1981/1959 ● Thorsten Wiesel 1981/1959 ● Kenichi Fukui 1981/1962 ● Ronald Hoffman 1981/1980 ● S. Chandrasekhar 1983/1961 ● William Fowler 1983/1961 ● John Polanyi 1986/1981 ● Dudley Herschbach 1986/1979 ● Yuan Lee 1986/1971 ● Donald Cram 1987/1962 ● Melvin Schwartz 1988/1970 	<ul style="list-style-type: none"> ● Elias Corey 1990/1968 ● Jerome Friedman 1990/1961 ● Henry Kendall 1990/1961 ● Rudolph Marcus 1992/1962 ● Mario Molina 1995/1995 ● Richard Smalley 1996/1972 ● Steven Chu 1997/1988 ● Daniel Tsui 1998/1985 ● Ahmed Zewail 1999/1986 	<ul style="list-style-type: none"> ● Alan Heeger 2000/1988 ● Alan MacDiarmid 2000/1970 ● Jack Kilby 2000/1958 ● Herbert Kroemer 2000/1995 ● Paul Greengard 2000/1984 ● Eric Kandel 2000/1963 ● Wolfgang Ketterle 2001/1990 ● John Fenn 2002/1975 ● Daniel Kahneman 2002/1977 	<ul style="list-style-type: none"> ● Paul Lauterbur 2003/1956 ● Theodor Hansch 2005/1990 ● John Hall 2005/1991 ● Roy Glauber 2005/1962 ● Robert Grubbs 2005/1987 ● Thomas Schelling 2005/1960 ● George Smoot 2006/1985 ● Yoichiro Nambu 2008/1965 	<ul style="list-style-type: none"> ● Andre Geim 2010/2008 ● Konstantin Novoselov 2010/2008 ● Daniel Shechtman 2011/1999 ● David Wineland 2012/1982 ● Francois Englert 2013/1963 ● Peter Higgs 2013/1964 ● Shuji Nakamura 2014/1991 ● Isamu Akasaki 2014/1991 ● Hiroshi Amano 2014/1991 ● William Moerner 2014/1995 ● J. Fraser Stoddart 2016/2008



AWARD YR / SUPPORT BEGAN

Questions?