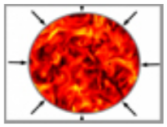
National Science Foundation
Directorate for Mathematical & Physical Sciences (MPS)

STORING ENERGY IN TURBULENT EDDIES

News From the Field

~~COMPRESSING TURBULENCE TO IMPROVE INERTIAL CONFINEMENT FUSION EXPERIMENTS~~

March 15, 2016



Article describes possible new paradigm for inertial confinement fusion experiments.
Full Story

Source
DOE/Princeton Plasma Physics Laboratory

The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. In fiscal year (FY) 2016, its budget is $7.5 billion. NSF funds reach all 50 states through grants to nearly 2,000 colleges, universities and other ins proposals for funding and makes a million in professional and service

This work was supported by DOE through Contracts No. DE-AC02-09CH1-1466 and NNSA 67350-9960 (Prime No. DOE DE-NA0001836), by DTRA HDTRA1-11-1-0037, and by **NSF Contract No. PHY-1506122**.

PRL **116,** 105004 (2016) PHYSICAL REVIEW LETTERS week ending 11 MARCH 2016

Sudden Viscous Dissipation of Compressing Turbulence

Seth Davidovits
Princeton University, Princeton, New Jersey 08540, USA

Nathaniel J. Fisch
Princeton University, Princeton, New Jersey 08540, USA
Princeton Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540, USA
(Received 28 October 2015; published 11 March 2016)

Compression of turbulent plasma can amplify the turbulent kinetic energy, if the compression is fast compared to the viscous dissipation time of the turbulent eddies. A sudden viscous dissipation mechanism is demonstrated, whereby this amplified turbulent kinetic energy is rapidly converted into thermal energy, suggesting a new paradigm for fast ignition inertial fusion.

DOI: 10.1103/PhysRevLett.116.105004

Curiosity-Driven Research: an Unsolved Problem in Plasma Physics

Vyacheslav (Slava) Lukin *08

Program Director for Plasma Physics & Accelerator Science

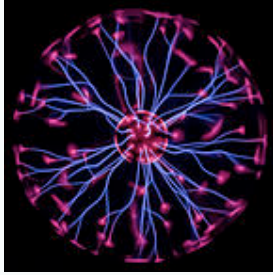
NSF Physics Division

Solved and Unsolved Problems in Plasma Physics

A symposium in honor of Nathaniel J. Fisch

March 29, 2016

Prequel:
Another Unsolved Problem



8.5%

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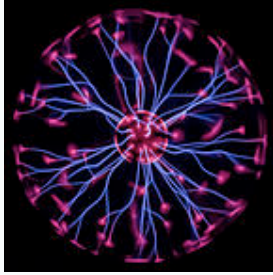
Another Unsolved Problem



Female fraction of the APS Division of Plasma Physics membership as of January 2016:

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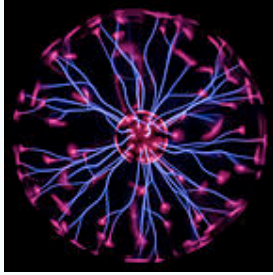

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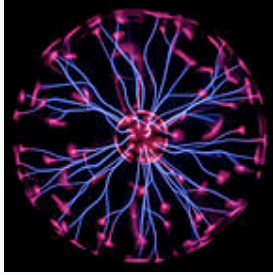
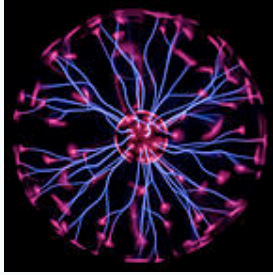
is the lowest of any APS Unit

Curiosity-Driven Research



"…**does science, or knowledge, really need a justification?** It is hard to imagine that any man or woman since the dawn of intelligent life has not gazed out at the sky on a moonless night, wondering how it came to be and what is our place in this vast and wondrous firmament. And each time science has advanced our understanding of those countless dots of light, it has uncovered more mysteries, more questions. **The curiosity of our species knows no bounds**; more remarkably, neither does our capacity for satisfying it. **And that is truly wonderful in itself, even if it doesn't lead to a better toaster.**"

Curiosity-Driven Research



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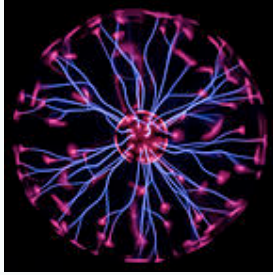
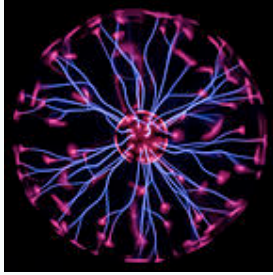
By NYT Editorial Board [Feb 16, 2016] commenting on the press coverage of LIGO detection of gravitational waves

Curiosity-Driven Research



"Recently, news broke of the **discovery of gravitational waves**, as first predicted by Albert Einstein. The National Science Foundation's support for the LIGO project that led this effort **is a perfect example of pursuing breakthrough science that is in the national interest**..."

Curiosity-Driven Research



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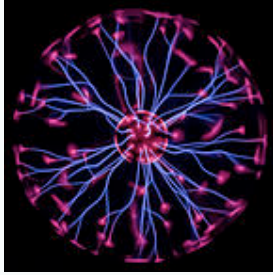
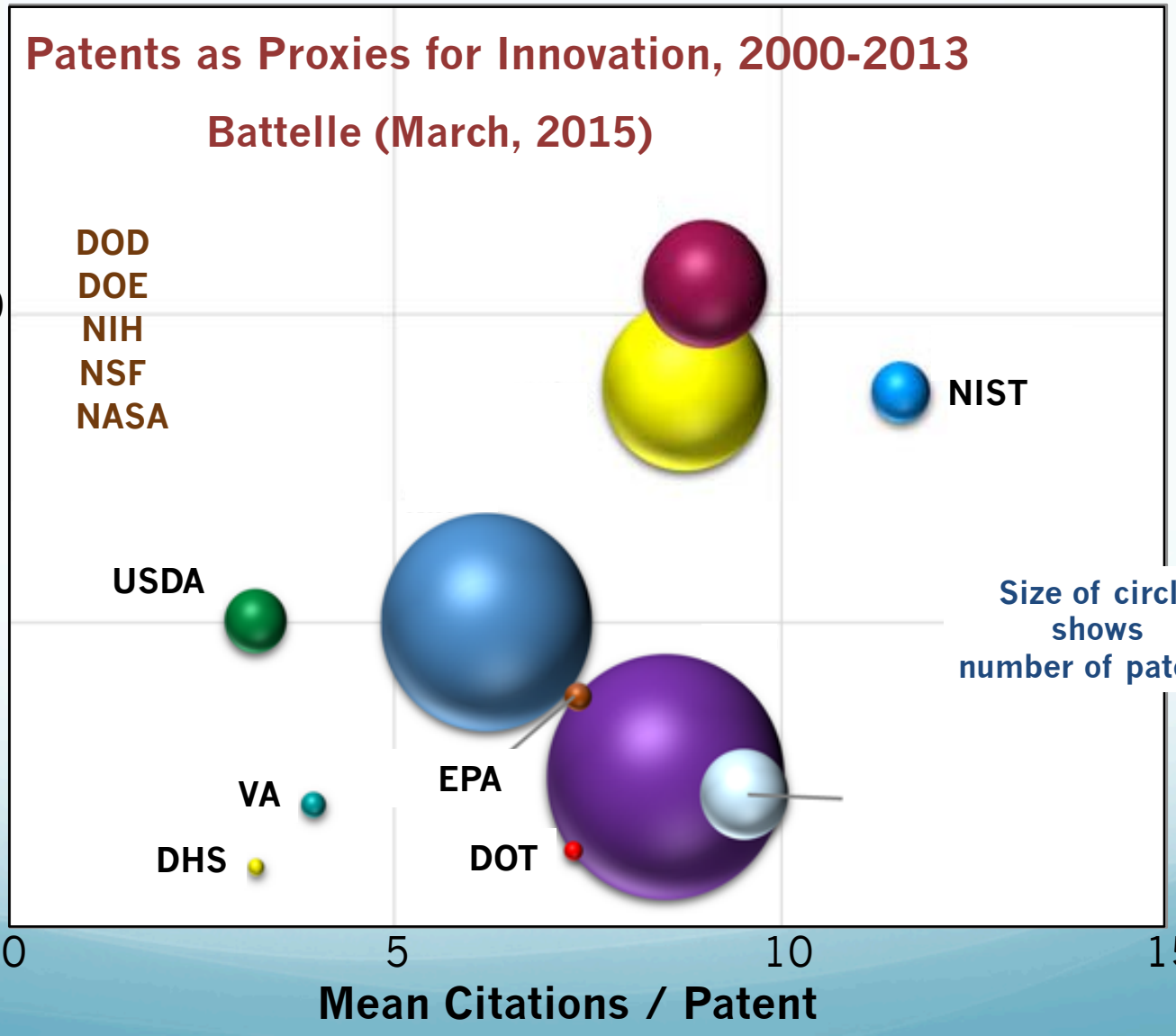
NYT, To the Editor [Feb 25, 2016]

LAMAR SMITH

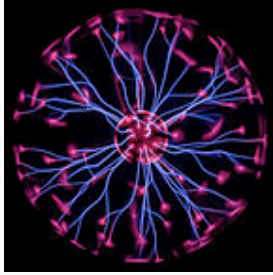
Chairman, House Committee on Science, Space and Technology

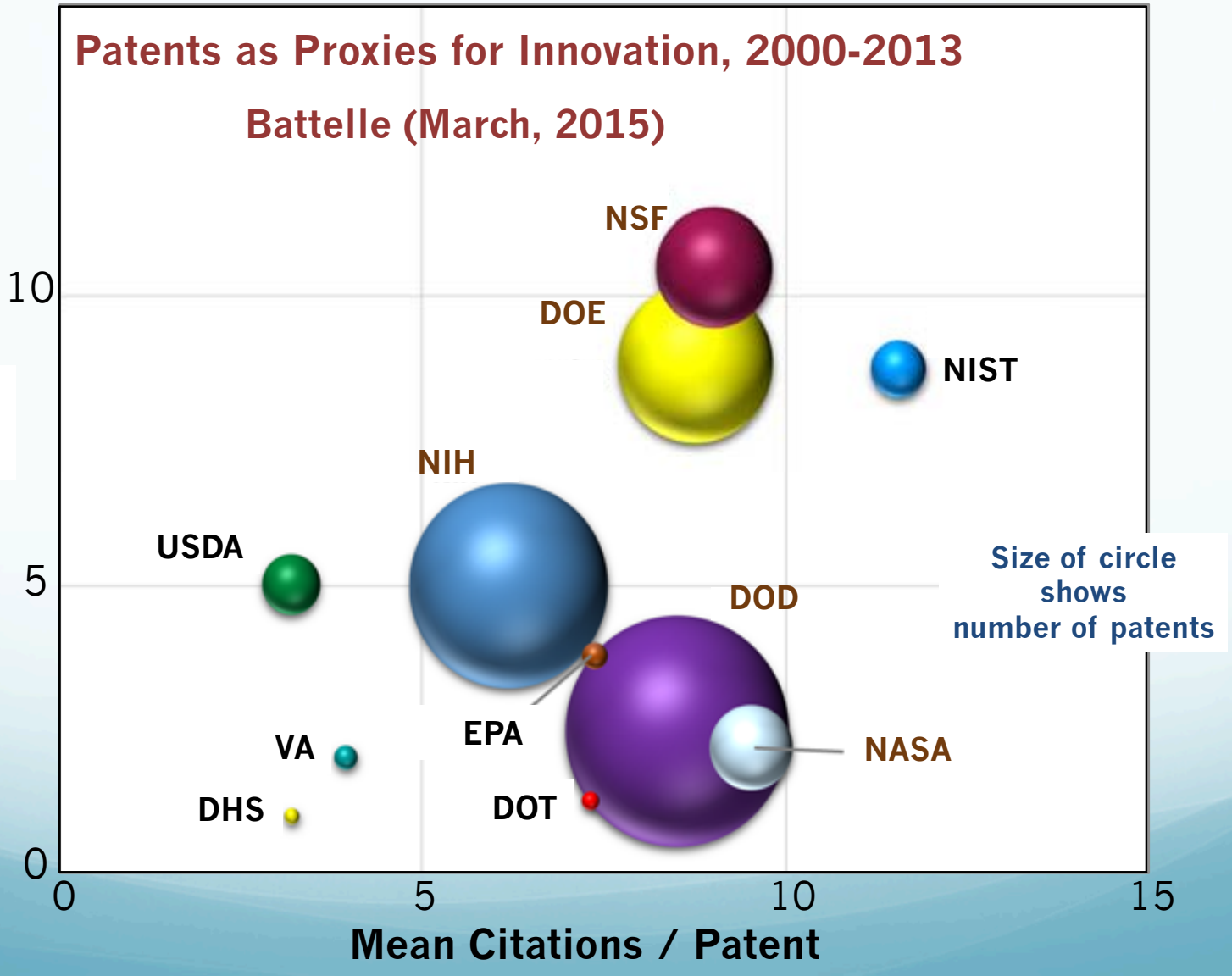
Curiosity-Driven Research

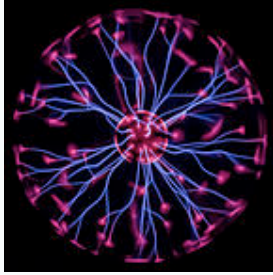




Curiosity-Driven Research

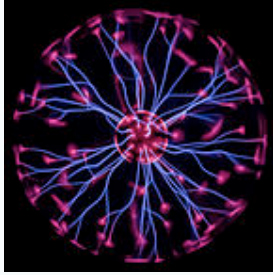






What is Curiosity-Driven Plasma Physics?

Plasma Physics



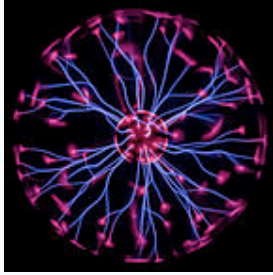
Plasma Physics is a study of matter and physical systems whose intrinsic properties are governed by collective interactions of large ensembles of free charged particles.

Such physical systems are thought to encompass 99.9% of the visible Universe, where the collective behavior in plasmas leads to phenomena as varied as magnetization from cosmic to planetary scales, particle energization throughout the Universe, and light shows from extragalactic gamma ray bursts to aurorae here on Earth.

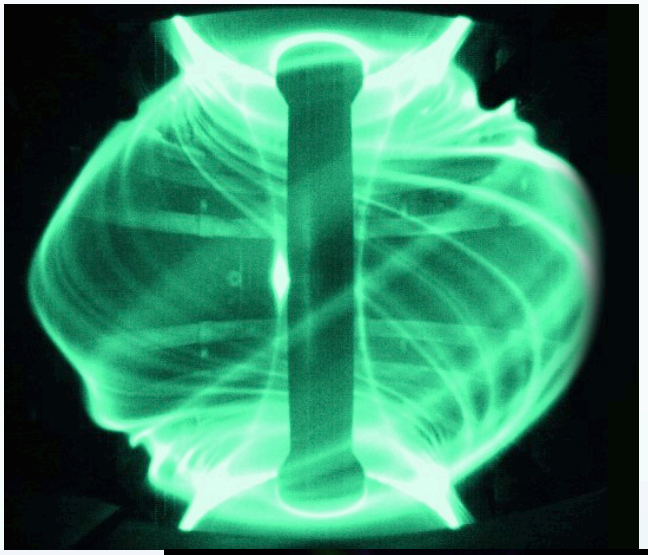
Statistical mechanics of ultracold quantum plasmas, wave-particle interactions in ultra-intense electro-magnetic fields, and dusty plasma crystallization are just a few of the topics of current interest that exemplify the breadth of Plasma Physics.

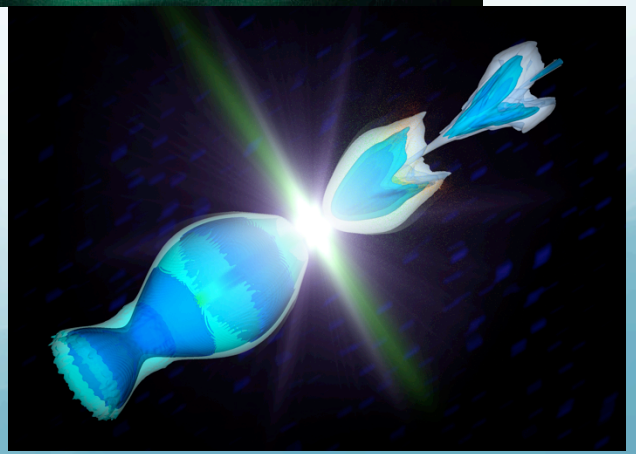
with input from many members of plasma physics community

Plasma Applications

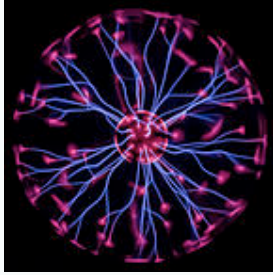


Plasma Physics has applications to Space Physics and Astrophysics, Materials Science, Fusion Science, Accelerator Science, Medicine, and many branches of Engineering.





Many fundamental results in Plasma Physics have been inspired by these disciplines.



Final Thought

Plasma Science
= Plasma Physics + Applications

where:

Plasma Physics is a study of matter and physical systems whose intrinsic properties are governed by collective interactions of large ensembles of free charged particles. 99.9% of the visible Universe is thought to consist of plasmas. The underlying physics of the collective behavior in plasmas has applications to space physics and astrophysics, materials science, fusion science, accelerator science, medicine, and many branches of engineering.

The next *Plasma Science Decadal Survey* is soon to be initiated. Per above, it should address plasma physics and the full set of its applications, and involve representatives of all the stakeholder communities.