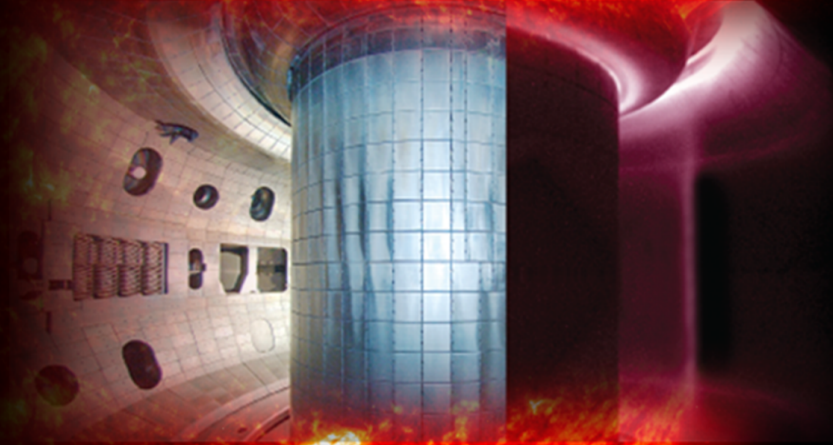
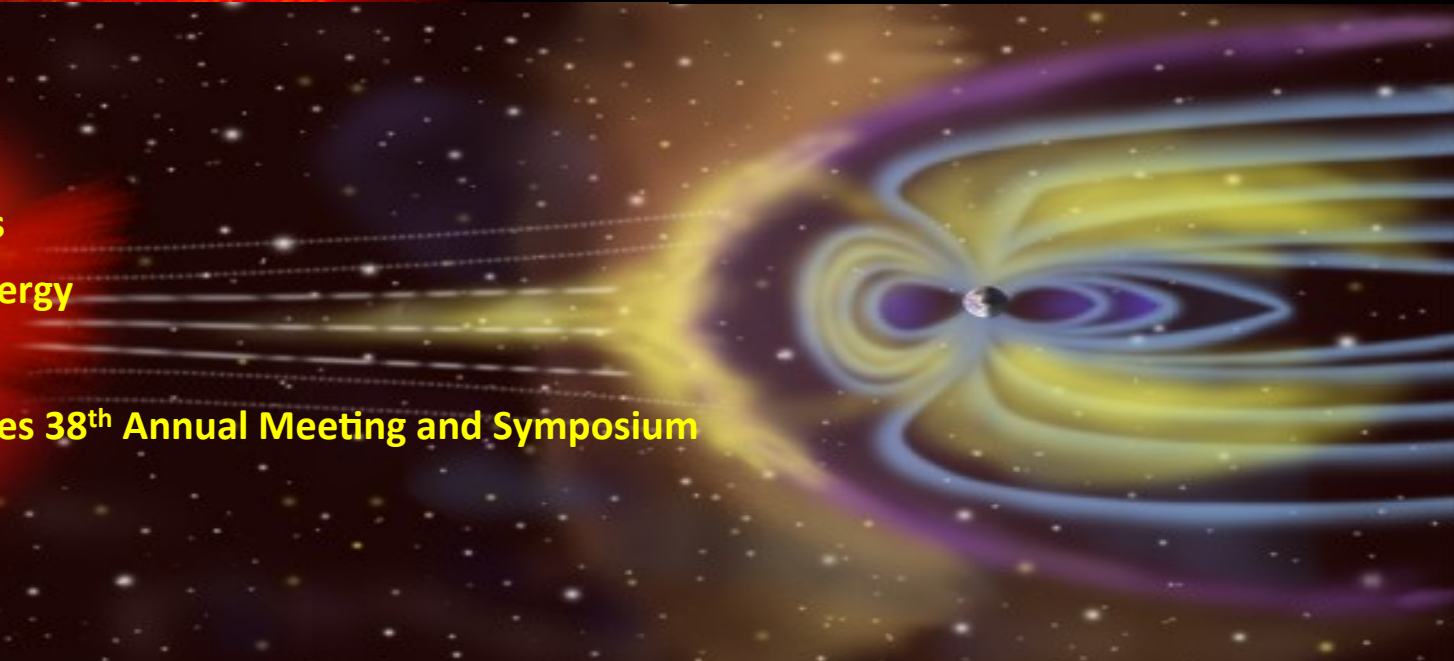


Successes of the Early Career Research Program



Nirmol Podder
Office of Science
Fusion Energy Sciences
U.S. Department of Energy

Fusion Power Associates 38th Annual Meeting and Symposium
Washington, DC
December 7, 2017



**To support the research careers of junior scientists
and the development of individual research programs
to build the plasma and fusion science community.**

FY 1997 – 2008:

- FES operated Junior Faculty Award Program for 12 years
- Supported the development of research programs of exceptionally talented plasma physics **faculty** early in their careers
- Applications from all areas of plasma physics including magnetic fusion were sought but **basic plasma science areas were emphasized**
- Annual funding up to \$150,000 per award **for 3 years**
- **38 awards were made by FES (\$17M+ investment) over 12 years**

FY 2010 – Present:

- Office of Science wide Early Career Research Program was launched with the Recovery Act funding and solicitations (FOA and Lab Notice) were issued for FY 2010 awards



FES Junior Faculty Development Awards



✓ 95% (36 out of 38) awardees went on to achieve tenure

Funding opportunity for early career scientists from both universities and DOE labs

- Recovery Act Funding covered FY 2010 awards only; subsequent year support was continued with program funds
- Supports the development of individual research programs of outstanding **university faculty and lab scientists** early in their careers
- Applications from all six SC programs (ASCR, **BER**, **BES**, FES, HEP, & NP) are sought
- Annual funding at least \$150,000 per year for university grants, or \$500,000 per year for lab awards, **for 5 years**
- Untenured assistant or associate professors on the tenure-track or staff scientists at DOE labs are eligible
- Within 10 years of the PI's Ph.D.
- One application per PI is allowed in an annual competition
- A PI may compete 3 times only
- FOA and Lab Notice for FY 2018 awards have been delayed but anticipated soon
- <http://science.energy.gov/early-career/>

Funding opportunities

- Recovery Act Funding was continued
- Supports the development of university faculty
- Applications from abroad sought
- Annual funding year for lab awards
- Untenured assistant scientists at DOE
- Within 10 years of PhD
- One application per year
- A PI may compete
- FOA and Lab No
- <http://science.energy.gov/early-career/>

	FES Junior Faculty Award	SC Early Career Award
Applicant Eligibility	Faculty	Faculty & Lab Scientists
Topical Areas	Mostly Basic Plasma	Fusion & Basic Plasma
Grant Period	3 Years	5 Years
PECASE Eligibility	No	Yes
Participating Program Offices	FES	ASCR, BER , BES , FES, HEP, & NP

Topical Areas for FES Early Career Research

- Magnetic Fusion Energy Science Experimental Research
- Magnetic Fusion Energy Science Theory and Simulation
- High-Energy-Density Plasma Science
- General Plasma Science Experiment and Theory
- Fusion Nuclear Science, Materials Research and Enabling R&D Programs for Fusion

FES Early Career Research Awards during FY

2010-2017

- Applications in all 5 topical areas are received
- On average FES received about 35 applications per year
- Made about 5 awards per year (39 total = 23 university + 16 lab awards over 8 years)
- MFES Exp. Research (11), MFES Theo. & Sim (6), HEDLP (11), GPS (5), and FNS (6)
- 18% (7 out of 39) of the recipients are women
- Success rate (~14%)
- **Investment on new awards \$2.3M+ per year (\$18M+ over the last 8 years), and a projected total investment counting continuation years will exceed \$56M**



Dr. Jason Trelewicz
Stony Brook Univ.
Plasma-facing materials
applications



Dr. Julia Mikhailova
Princeton University
Attosecond light-field control
of high-density plasmas



Dr. Juan Trelles
U. Massachusetts-Lowell
Plasmas in contact with liquids



Dr. David Green (ORNL)
Simulation of magnetically
confined fusion plasmas



Dr. Frederico Fiuza (SLAC)
Particle acceleration in
HED plasmas



Dr. Adam Sefkow (U. Rochester)
Hybrid fluid-kinetic modeling
efforts for HEDP and ICF Science



Dr. Peter Bruggeman
U. Minnesota
Interaction of plasma
with biomaterials



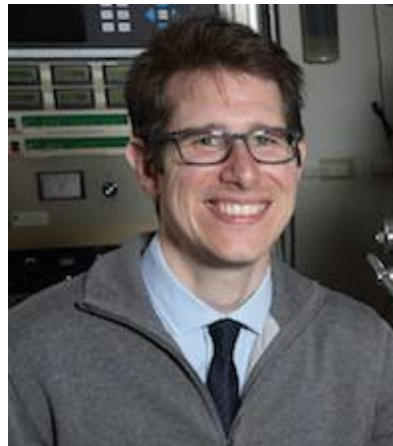
Dr. Devesh Ranjan, GIT
Blast-wave-driven turbulence



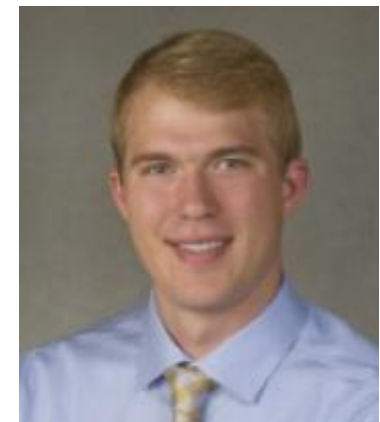
Dr. Egemen Kolemen, PU
Prediction of transient
events in tokamaks



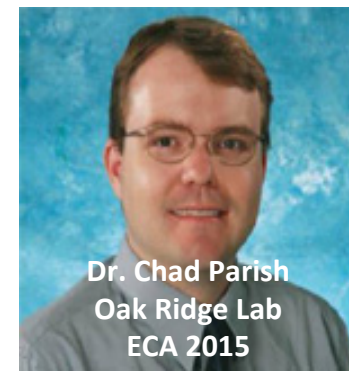
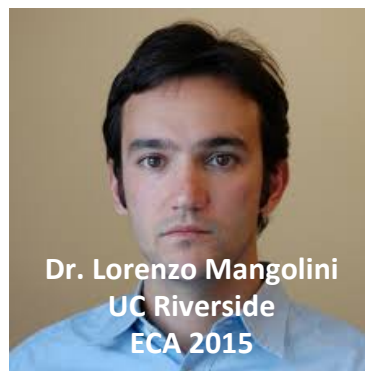
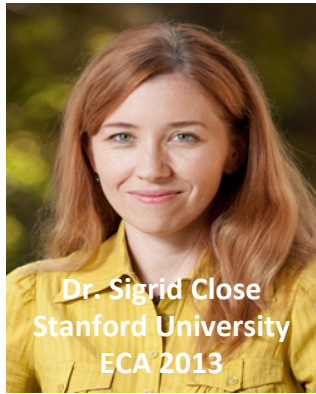
Dr. Felicie Albert, LLNL
X-ray sources for HED
science experiments

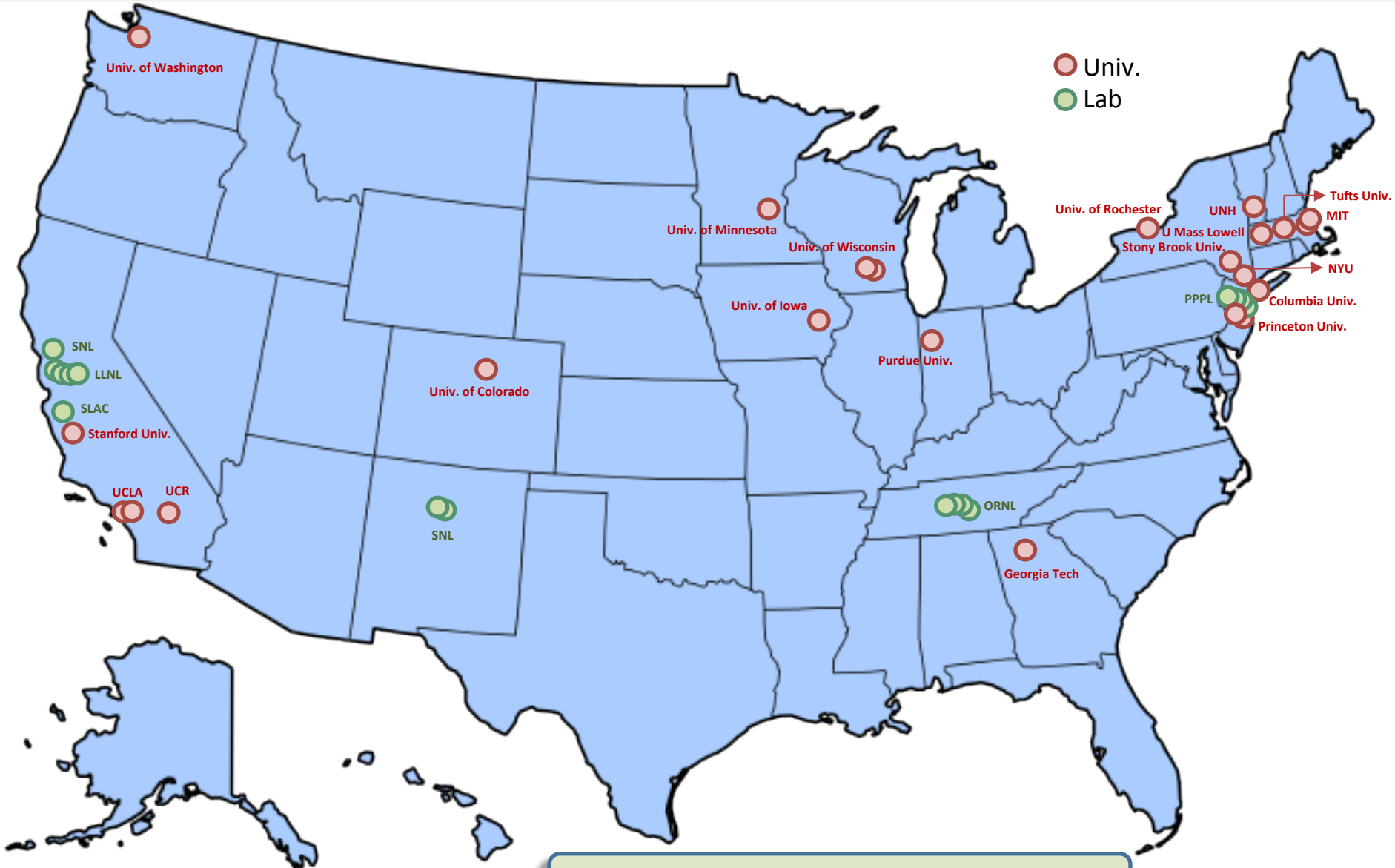


Dr. Robert Kolasinski, SNL
Dynamic response of surfaces
to plasma exposure



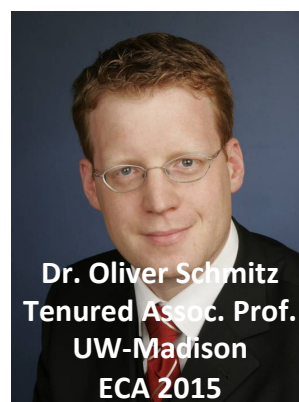
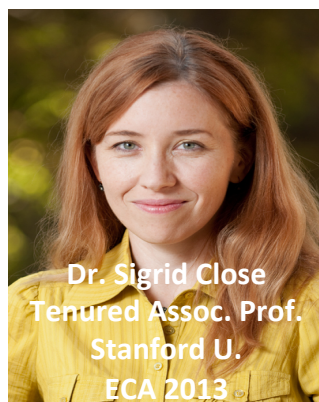
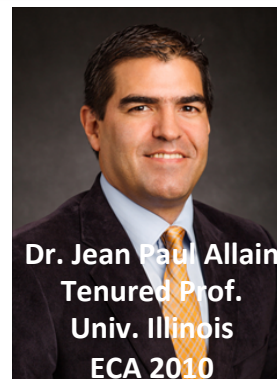
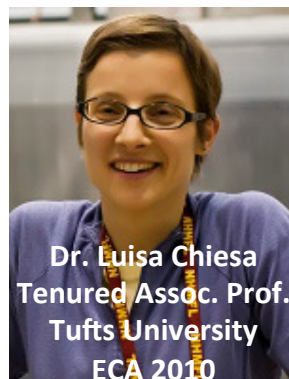
Dr. Scott Baalrud, U. Iowa
Transport properties of
magnetized HED plasmas





✓ Total ECA: 39 - University: 23 and DOE Laboratory: 16

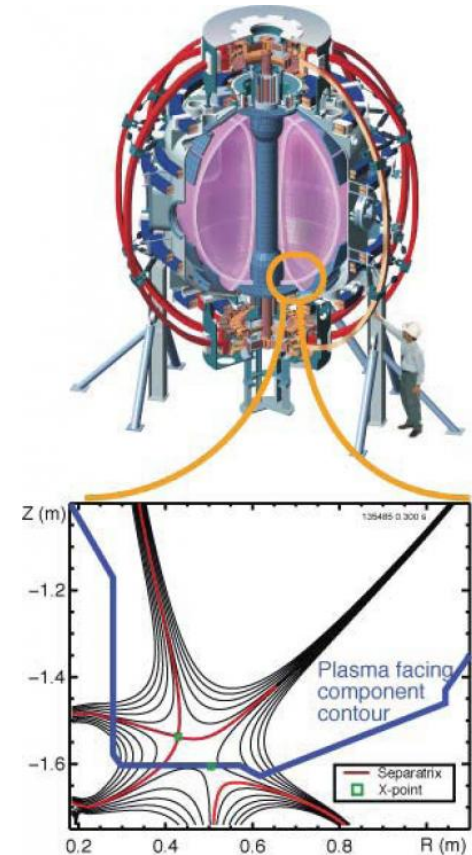
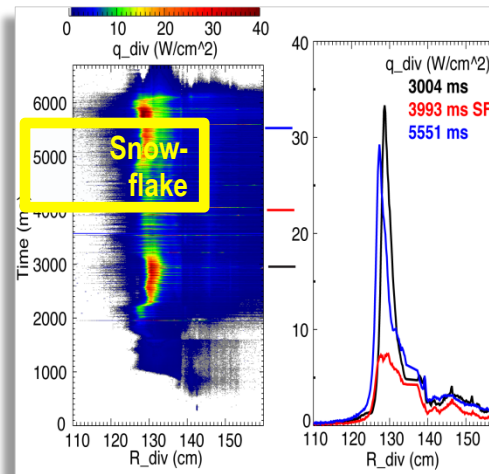
Among 23 University Awardees, 12 Awardees Who Were up for Tenure Have Achieved Tenure so far





The Snowflake Divertor:

- Initial results: peak heat loads reduced from 4-7 to 0.5-1 MW/m²
- Creates poloidal magnetic field lines with a snowflake shape.
- Creates a large zone flaring the plasma flow, dramatically decreasing heat fluxes.
- Promising first step: compatibility with attractive core plasmas is a future research topic



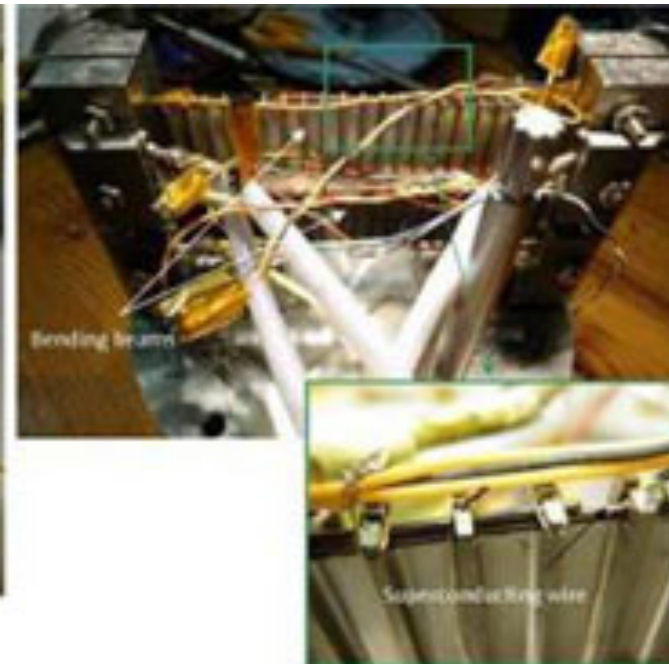
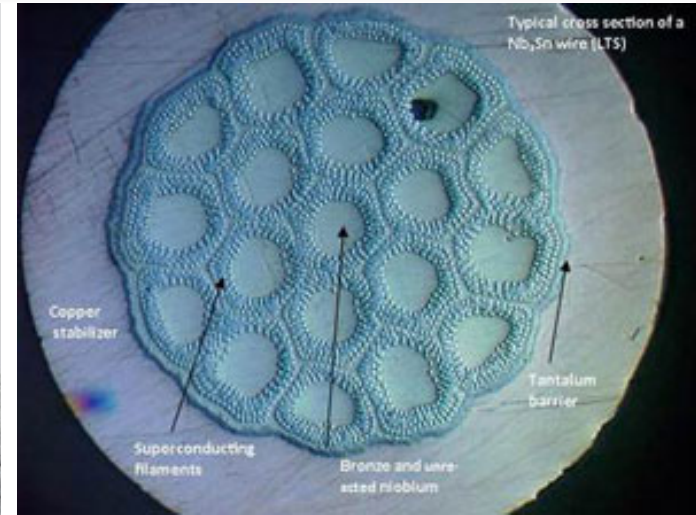
Advanced High Heat Flux Divertor Program on NSTX
Dr. Vlad Soukhanovskii, Lawrence Livermore National Laboratory
SC Early Career Research Award FY 2010



The Roger W. Boom Award is given to Prof. Luisa Chiesa for her research on the electromechanical characterization of low temperature superconductors (LTS) and high temperature superconductors (HTS) for powerful magnets used in energy systems and basic research. In addition, Dr. Chiesa has established a cryogenic engineering and applied superconductivity laboratory for graduate studies, and continues to educate and mentor young research engineers.

Superconducting technology for magnet systems in fusion machines

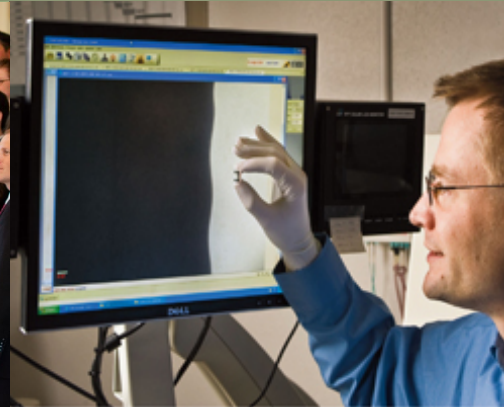
**Prof. Luisa Chiesa, Tufts University
SC Early Career Research Award FY 2010**





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ENERGY

2012 PECASE Award to Early Career Awardee



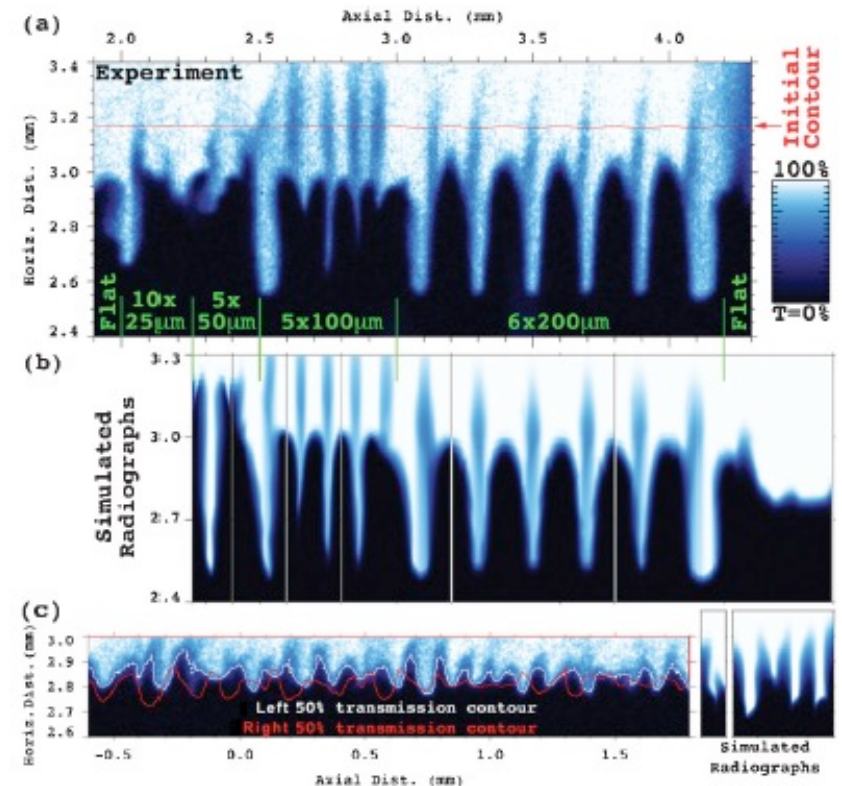
2012 Presidential Early Career Award for Science and Engineering (PECASE):

For developing innovative techniques to study the properties of instabilities in magnetized-high-energy-density plasma, enabling quantifiable comparison between experiment and simulation needed for validating cutting-edge radiation-hydrodynamics codes, and for demonstrating substantial leadership qualities in high-energy-density-laboratory-plasma (HEDLP) physics.

Fundamental instability measurements in magnetically driven z-pinch liner implosions

Dr. Daniel Sinars, Sandia National Laboratories

SC Early Career Research Award FY 2011

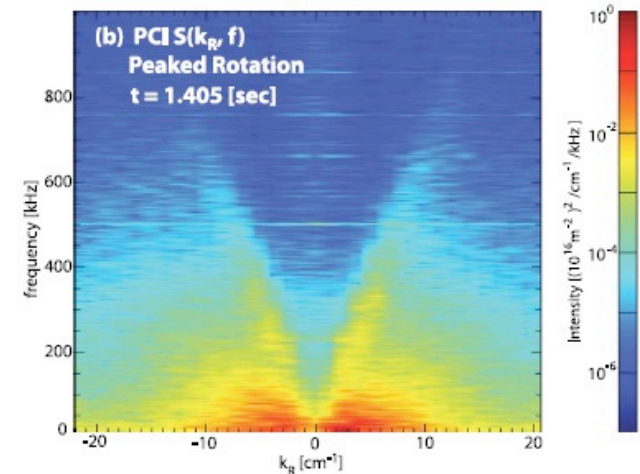
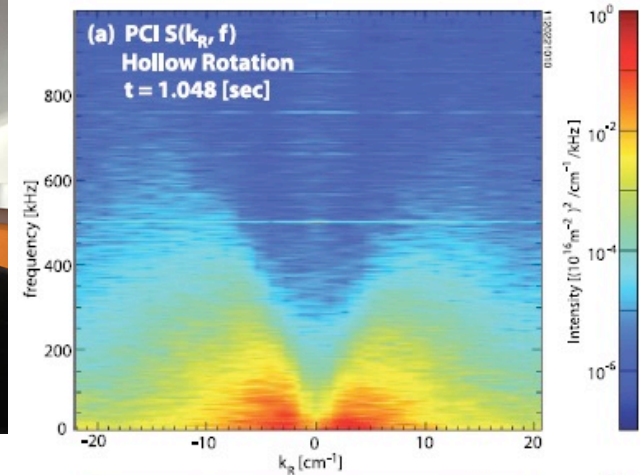




Anne White received the 2014 Katherine E. Weimer Award, which recognizes outstanding achievement in plasma science research by a female physicist in the early years of her career. White's research focuses on turbulent transport in fusion plasmas, with the goal of controlling the transport and improving performance of tokamaks.



Prof. Anne White has been awarded the 2014 Junior Bose Award for Excellence in Teaching. This award is given annually to an outstanding contributor to education from among the junior faculty of the School of Engineering. Her students describe her as an engaging, enthusiastic, and committed teacher and mentor. Prof. White is the second NSE faculty member to earn the prestigious Junior Bose Award in recent years.



Electron Temperature Fluctuation Measurements for Validation of Gyrokinetic Transport Models at Alcator C-Mod

Prof. Anne White, Massachusetts Institute of Technology

SC Early Career Research Award FY 2011



U.S. DEPARTMENT OF
ENERGY

2014 PECASE Award and 2017 AGU Carrington Award to Early Career Awardee



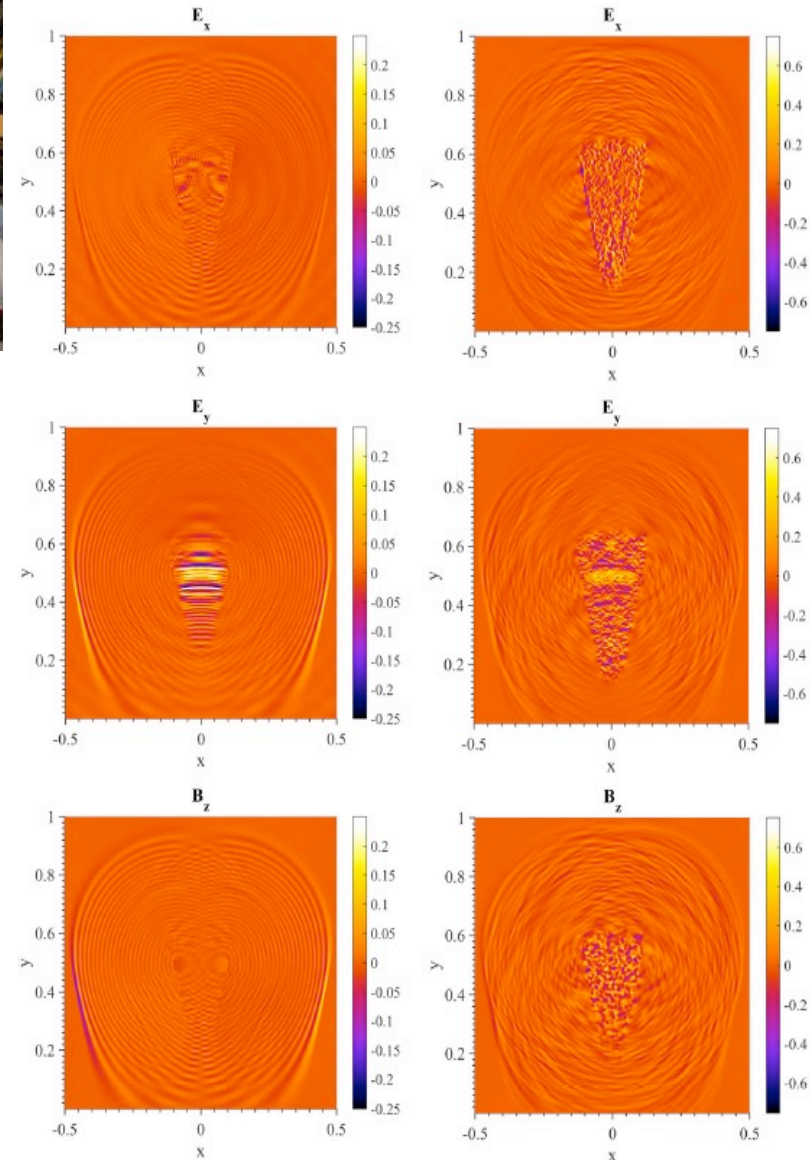
2014 PECASE Award (Nominated by NSF)

For unique and fascinating discoveries related to the effects of meteoroid impacts on the atmosphere and spacecraft, leading to new understanding and practical benefits.

2017 Space Physics for Science and Aeronomy Richard Carrington Award

In recognition of significant and outstanding impact on students' and the public's understanding of our science through their education and/or outreach activities.

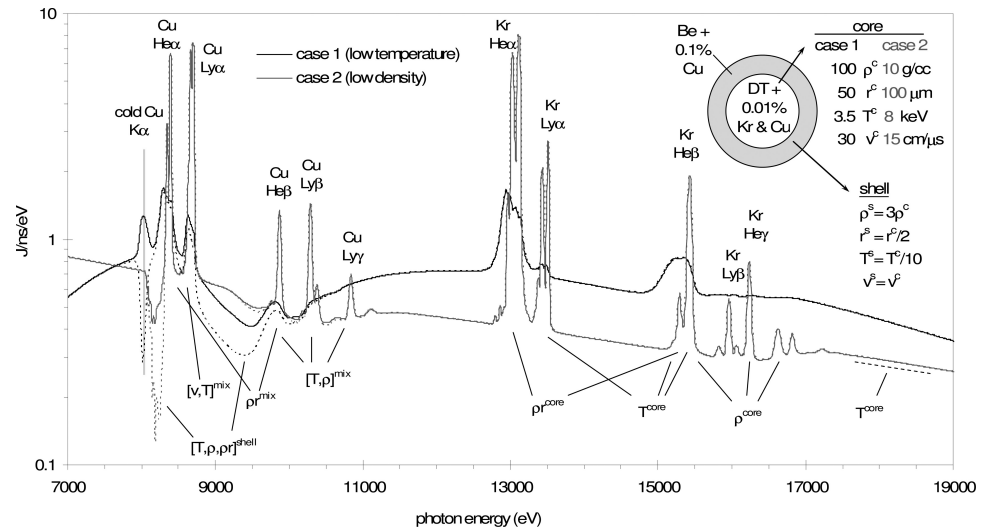
Experiments and Simulations of Hypervelocity Impact Plasmas
Prof. Sigrid Close, Stanford University
SC Early Career Research Award FY 2013





U.S. DEPARTMENT OF
ENERGY

2017 PECASE Award to Early Career Awardee



2017 Presidential Early Career Award for Science and Engineering (PECASE)

For contributing to the tools used to model and interpret data from high-energy-density experiments and astrophysical plasmas and for leading experiments to study the response of irradiated metal foils at the high-intensity X-ray laser at Stanford's Linear Coherent Light Source. Her main work combines models with data collected on high-precision instruments developed and fielded by other scientists, with the goal to find a consistent story about what happens on the nanosecond time scales of the Z experiments.

Non-equilibrium atomic physics in high-energy-density matter

Dr. Stephanie Hansen, Sandia National Laboratories

SC Early Career Research Award FY 2014



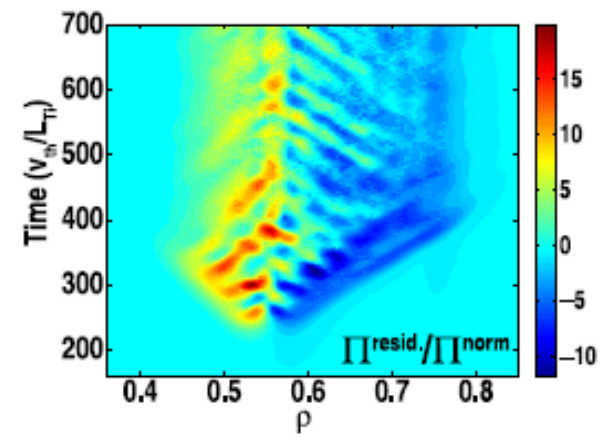
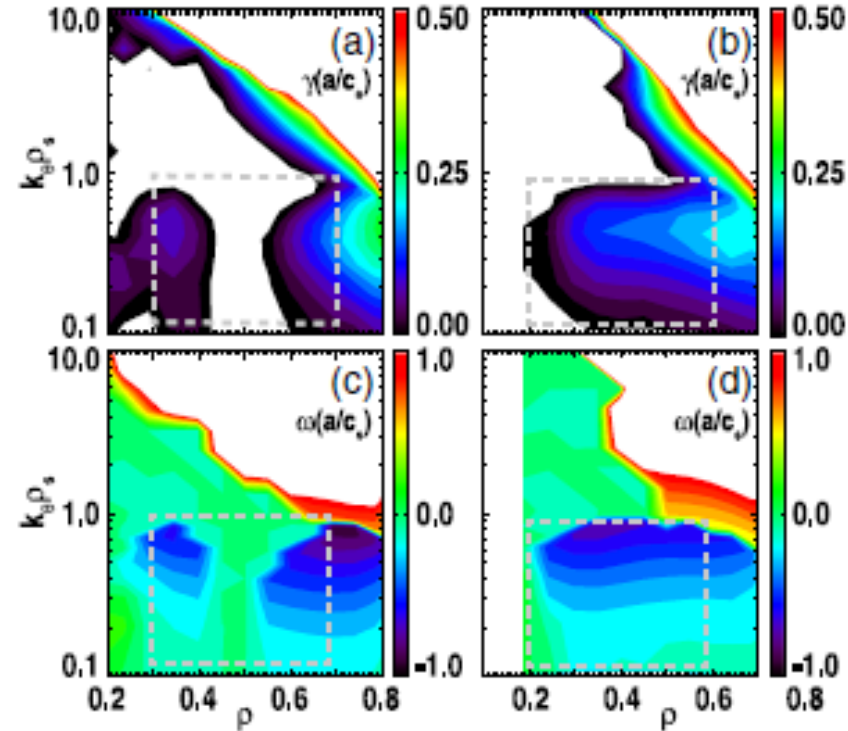
For a breakthrough in the development of fusion diagnostics and the creative use of radio frequency waves to heat the plasma that fuels fusion reactions.

And, for developing diagnosis and analysis system for main ion behavior in the DIII-D tokamak and contributing to turbulence-driven rotation at the edge of the plasma and compare with theoretical predictions.

Exploration of main-ion properties at the boundary of fusion reactors

Dr. Brian Grierson, Princeton Plasma Physics Lab

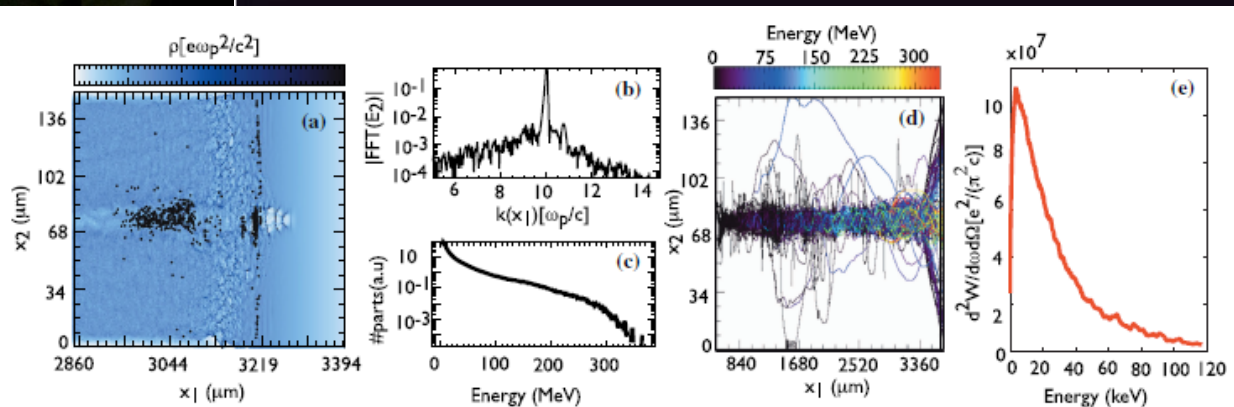
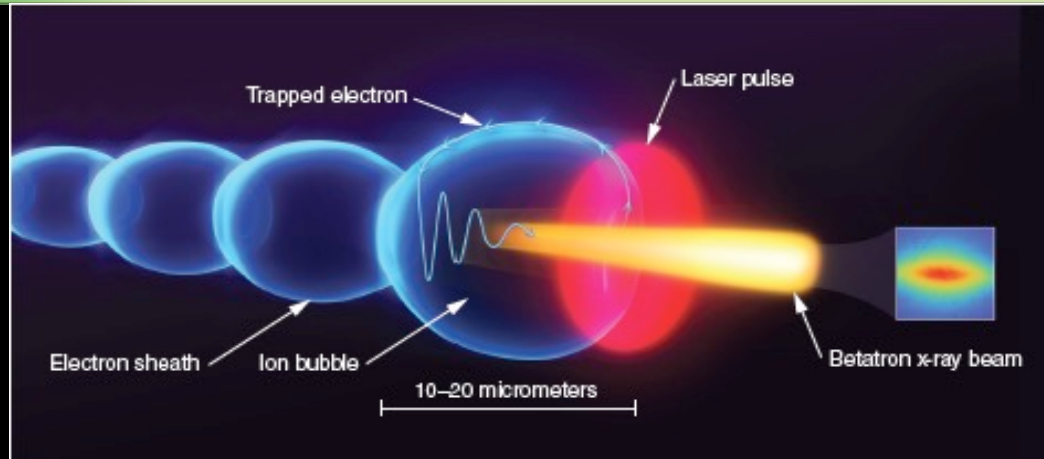
SC Early Career Research Award FY 2014





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ENERGY

2017 APS Weimer Award and 2017 Fabre Prize to Early Career Awardee



For pioneering development and characterization of X-ray sources from laser-wakefield accelerators and Compton scattering gamma-ray sources for applications in high energy density science and nuclear resonance fluorescence.

2017 Fabre Prize for her contributions to the physics of laser-driven inertial confinement fusion (ICF) and laser-produced plasmas.

Laser driven x-ray sources for high energy density science experiments

Dr. Felicie Albert, Lawrence Livermore National Laboratory

SC Early Career Research Award FY 2016

FPA Excellence in Fusion Engineering Award to Early Career Awardees



2014

**Dr. Daniel Sinars, SNL
SC ECA FY 2011**

For leadership in high energy density physics experiments on the Z facility at Sandia and many scientific contributions to understanding wire-array implosions for indirect drive inertial confinement fusion and for magnetically-driven implosions being studied for the MagLIF approach to inertial confinement for fusion energy applications.



2014

**Prof. Anne White, MIT
SC ECA FY 2011**

For leadership in the world effort to understand turbulent transport in tokamaks, a critical feasibility requirement for tokamak-based fusion power plants, for many other scientific contributions to the field of fusion research, and devotion to training the next generation of fusion scientists and engineers.



2015

**Prof. Francesco Volpe
Columbia University
SC ECA FY 2011**

For contribution to fusion science and engineering in many areas, including MHD instability and control and RF heating. The FPA Board especially acknowledged the leadership role he is playing in innovations for stellarator and tokamak-torsatron hybrid configurations.



2017

**Prof. Adam Sefkow
Univ. Rochester
SC ECA FY 2017**

In recognition of his scientific contributions on a range of topics, including magneto-inertial fusion, short-pulse and long-pulse laser-plasma interaction physics, and intense charged-particle beam transport.

During the last eight years, DOE's six SC Program Offices funded 308 early career scientists at 120 universities across 44 states. 25% of the recipients are women.

Some results from a recent survey of first 47 university awardees (FY 2010 cohort)

- 94% (44 out of 47) of the university awardees who remained at their respective universities were tenured.
- 64% (30 out of 47) of the university awardees had successfully competed for follow-on funding from the Office of Science, also reported to have won follow-on funding for independent research from several other federal agencies.
- The group was highly recognized with prestigious awards, e.g., PECASE, R&D 100, Fulbright.
- Nearly 80% (37 out of 47) of PIs reported that they have remained involved in various SC programs.

Some examples of comments from various SC Committee of Visitors Report:

"The group of funded PIs includes highly productive scientists with strong track records of high-impact research activity as well as promising early-career scientists." BER COV 2016

"The new Office of Science Early Career Research Program provides a promising path for a new and more diverse group of researchers to participate in OFES programs" FES COV 2010

To support the research careers of junior scientists and the development of individual research programs to build the plasma and fusion science community.

**FES has operated two successful programs:
previously Junior Faculty Award program
and currently on a journey to a successful
Early Career Research program.**