UCLA Capabilities in Fusion/Plasma Science and Technology

Troy Carter, Director PSTI
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UCLA Plasma Science and Technology Institute

- UCLA PSTI: umbrella institute for research and education activities in plasma and fusion science and technology across campus
- Research activities in Physics and Astronomy, Electrical Engineering, Earth and Space Sciences, Atmospheric and Oceanic Sciences, Chemical Engineering, Mechanical and Aerospace Engineering, Materials Science and Engineering
  - ~30 Faculty, over 100 other PhD scientists on campus working in related areas, many students and postdocs
- Expertise in fusion plasma physics (MFE and ICF), fusion technology, particle-in-cell simulation of plasmas, high temperature plasma diagnostics, plasma waves (e.g. ICRF), laser-plasma interactions, fusion materials and PMI, design and construction of experimental hardware, …
Senior Scientists in fusion and plasma science and technology at UCLA

- **P&A Faculty:** Troy Carter, Warren Mori (joint), Paulo Alves, Chris Niemann, Jamie Rosenzweig, Pietro Musumeci, Walter Gekelman (emeritus), George Morales (emeritus); Researchers (PIs): Terry Rhodes, Frank Tsung, Steve Vincena, Neal Crocker, Shreekrishna Tripathi, Pat Pribyl, David Brower, Victor Decyk, Lothar Schmitz, Kshitish Barada, Gerard Andonian, Gil Travish, Mostafa El Alaoui, David Schriver, Jean Berchem, Tony Peebles (emeritus)

- **MAE Faculty:** Mohamed Abdou, Richard Wirz, Ann Karagozian, Tim Fischer, Nasr Ghoneim (emeritus); Researchers: Sergei Smolentzev, Alice Ying, Neil Morley

- **EE Faculty:** Warren Mori (joint), Chan Joshi; Researchers: Chris Clayton, Sergei Tochitsky, Ken Marsh

- **MSE Faculty:** Jaime Marian, Jane Chang (joint with Chem Eng)

- **EPSS/AOS Faculty:** Jacob Bortnik, Vassilis Angelopoulos, Marco Velli, Chris Russell, Larry Lyons, Margaret Kivelson (emerita), Bob McPherron (emeritus), Ray Walker (emeritus); Researchers: Xiaojia Zhang, Xin An, Krishnan Khurana, Andrei Runov, Bob Strangeway, James Weygand, Anton Artemyev

- **Chem Eng Faculty:** Jane Chang

- **Math Faculty:** Chris Andersen
The Basic Plasma Science Facility: from fundamental plasma science to fusion-motivated studies

- DOE/NSF supported user facility for study of processes in magnetized plasmas (waves, turbulence, transport, energetic particles, shocks, reconnection…)

PIs: Carter, Gekelman, Morales, Niemann, Vincena
The Basic Plasma Science Facility: from fundamental plasma science to fusion-motivated studies

- DOE/NSF supported user facility for study of processes in magnetized plasmas (waves, turbulence, transport, energetic particles, shocks, reconnection…)

- Example fusion-relevant research: ICRF campaign (TAE technologies, GA, ORNL, PPPL, MIT…)

[Martin, et al. PRL 119, 205002 (2017)]
Phoenix Laser Lab


- Collisionless shocks, laser-matter interactions, Thomson scattering, …

PI: Niemann
Plasma Diagnostics Group

- Expertise in microwave and FIR diagnostics for high-temperature plasmas (interferometry, polarimetry, reflectometry, doppler backscattering, CECE, …)
- Expertise in turbulence and transport, energetic particle physics
- Diagnostics deployed all over the world (DIII-D, MAST-U, NSTX-U, EAST, Norman (C2-W), …)

Rhodes, Crocker, Schmitz, Brower, Peebles, Carter
Abdou group in MAE, long history of contributions to fusion technology

- Neutronics
- Tritium fuel cycle/blankets
- Liquid metals

3D modelling of MHD mixed convection flow in a vertical duct with transverse magnetic field and volumetric or surface heating

Tyler J. Rhodes*, Gautam Pulugundla, Sergey Smolentsev, Mohamed Abdou
UCLA, MAE Department, 44114 Engineering IV, 420 Westwood Plaza, Los Angeles, CA, 90095-1597, USA
Materials development and PMI studies

- **Wirz** group in MAE: plasma propulsion and materials/PMI for fusion

- ARPA-E GAMOW project to develop electrodes and PFC using novel metal foams
Materials development and PMI studies

- Wirz group in MAE: plasma propulsion and materials/PMI for fusion

- (ARPA-E project to develop electrodes and PFCs using novel plasma-infused foams)

- **Marian** group in MSE: understanding materials evolution under extreme conditions using multiscale computational modeling
UCLA Plasma Simulation Group

- World-leading capabilities in particle-in-cell simulations, home of OSIRIS code
- Research programs in Plasma-based Accelerators and Radiation Sources, ICF/IFE, plasma astrophysics

Mori, Alves, Decyk, Tsung