Stanford

# Mike Dunne

Professor of Photon Science

Photon Science Directorate

Resume available Online


**CONTACT INFORMATION**

- **Administrative Contact**

  Samira Baradaran

  **Email** samira@slac.stanford.edu


## Bio

### BIO

Mike Dunne is an expert in the design, construction and operation of a wide range of large-scale research facilities.

He is the Director of the Linac Coherent Light Source (LCLS), an internationally leading research facility, operated by Stanford University on behalf of the US Department of Energy, open to users from around the world. He is an Associate Laboratory Director of the SLAC National Accelerator Laboratory, and a full Professor of Photon Science at Stanford University.

LCLS represents a revolution in x-ray science. The x-rays produced by LCLS are a billion times brighter than can be produced by conventional sources, such as a synchrotron, and are delivered in ultrafast bursts - typically a few tens of femtoseconds (10^-15 seconds). This opens up transformational opportunities for the study of structural biology, quantum materials, ultrafast chemistry, and novel states of matter. Since its initial operation in 2009, LCLS has enabled a remarkable series of studies, via its ability to provide atomic resolution information, with freeze-frame ‘movies’ of how atomic, chemical and biological systems evolve on ultrafast timescales.

From 2010-2014, Mike was the Director for Laser Fusion Energy at the Lawrence Livermore National Laboratory (LLNL). His role was to ensure full advantage is taken of the National Ignition Facility (NIF), a $3.5 billion investment designed to demonstrate net fusion energy production. At LLNL, Mike also held the role of Program Director for high average power laser development, initiating a number of projects including the High Average power Petawatt Laser System (HAPLS), for the newly constructed ELI-Beamlines laser facility near Prague.

Mike was Director of the United Kingdom’s Central Laser Facility (CLF) from 2005-2010, working for the Science and Technology Facilities Council. The CLF is home to the world's most intense laser facilities, with science programs ranging from biomedical research and ultrafast material science, to the pursuit of a new generation of miniaturized particle accelerators. In 2008 he took on additional responsibility as Director of the Photon Science Department, developing coupled laser and accelerator facilities; pursuit of next-generation Free Electron Laser sources; and oversight of the final phase of the UK’s Synchrotron Radiation Source (SRS). This entailed senior management of a staff of ~150 people at both the Rutherford Appleton Laboratory and the Daresbury Laboratory. Mike was the International Project Leader for the European project ‘HiPER’, for which he created a consortium of 26 institutions across 10 countries.

Prior to this he worked for the UK Government at AWE Aldermaston, leading their plasma science research group. He played a major role in establishing the scope and mission of AWE's new "ORION" laser facility (~250 M$) to preserve the UK's national capability in this important area of strategic deterrence. From there he moved into a position developing the organization's strategy and assessment of the overall national technical capability to meet the demands of future missions.

Mike's personal research focuses on the development and application of X-ray science across a broad range of research activities, including the development and application of high power lasers to high energy-density science and nuclear fusion.

Mike obtained his doctorate in plasma physics from Imperial College, London. He is a Fellow of the Royal Society for Arts, Manufactures and Commerce, has received a number of international awards and is the author of over 180 technical papers, 11 patent applications, 60 invited talks, and over 80 press/media reports for the general public.

### ACADEMIC APPOINTMENTS

- Professor, Photon Science Directorate

### ADMINISTRATIVE APPOINTMENTS

- Director, Linac Coherent Light Source (LCLS), SLAC National Accelerator Laboratory, (2014- present)
- Associate Laboratory Director (ALD), SLAC National Accelerator Laboratory, (2014- present)

### HONORS AND AWARDS

- Fellow (FRSA), Royal Society for the encouragement of Arts, Manufactures and Commerce (2009-present)
- Awardee, US Secretary of Energy's Achievement Award, National Virtual Biotechnology Laboratory Team (2021)

### PROFESSIONAL EDUCATION

- PhD, Imperial College, London , Plasma Physics (1995)

### LINKS

- LCLS website: https://lcls.slac.stanford.edu/
- Photon Science bios: http://home.slac.stanford.edu/photonsciencefacultysearch.html#Dunne

## Research & Scholarship

### CURRENT RESEARCH AND SCHOLARLY INTERESTS

The Linac Coherent Light Source (LCLS) is the world's first X-Ray Free Electron Laser. It represents a revolution in x-ray science. The x-rays produced by LCLS are a billion times brighter than can be produced by conventional sources, such as a synchrotron, and are delivered in ultrafast bursts - typically a few tens of femtoseconds (10^-15 seconds).

This opens up transformational opportunities for the study of structural biology, quantum materials, ultrafast chemistry, and novel states of matter. Since its initial operation in 2009, LCLS has enabled a remarkable series of studies, via its ability to provide atomic resolution information, with freeze-frame 'movies' of how atomic, chemical and biological systems evolve on ultrafast timescales.

Based on this success, a billion-dollar upgrade project is now underway that will increase the repetition rate by 4 orders of magnitude (from 120 Hz to 1 MHz), opening up entirely new scientific opportunities.

Access to LCLS is open to everyone, based purely on the scientific merit of the proposed experiments.

# Teaching

## STANFORD ADVISEES

**Doctoral Dissertation Reader (AC)**

Kareem Hegazy

**Doctoral Dissertation Advisor (AC)**

Haoyuan Li, Zhen Su, Nan Wang

# Publications

## PUBLICATIONS

- **Inertial Confinement Fusion Power Plants** *Encyclopedia of Nuclear Energy*
  Dunne, M., Anklam, T., Meier, W.
  Elsevier.2021
- **Realizing split-pulse x-ray photon correlation spectroscopy to measure ultrafast dynamics in complex matter** *PHYSICAL REVIEW RESEARCH*
  Sun, Y., Dunne, M., Fuoss, P., Robert, A., Zhu, D., Osaka, T., Yabashi, M., Sutton, M.
  2020; 2 (2)
- **X-ray free-electron lasers light up materials science** *NATURE REVIEWS MATERIALS*
  Dunne, M.
  2018; 3 (9): 290–92
- **The Linac Coherent Light Source: Recent Developments and Future Plans** *APPLIED SCIENCES-BASEL*
  Schoenlein, R. W., Boutet, S., Minitti, M. P., Dunne, A. M.
  2017; 7 (8)
- **The Linac Coherent Light Source** *JOURNAL OF SYNCHROTRON RADIATION*
  White, W. E., Robert, A., Dunne, M.
  2015; 22: 472-476
- **LIFE TRITIUM PROCESSING: A SUSTAINABLE SOLUTION FOR CLOSING THE FUSION FUEL CYCLE** *FUSION SCIENCE AND TECHNOLOGY*
  Reyes, S., Anklam, T., Babineau, D., Becnel, J., Davis, R., Dunne, M., Farmer, J., Flowers, D., Kramer, K., Martinez-Frias, J., Miles, R., TAYLOR, C.
  2013; 64 (2): 187-193
- **LIFE: A SUSTAINABLE SOLUTION FOR DEVELOPING SAFE, CLEAN FUSION POWER** *HEALTH PHYSICS*
  Reyes, S., Dunne, M., Kramer, K., Anklam, T., Havstad, M., Mazuecos, A. L., Miles, R., Martinez-Frias, J., Deri, B.
  2013; 104 (6): 641-647
- **Lead (Pb) Hohlraum: Target for Inertial Fusion Energy** *SCIENTIFIC REPORTS*
  Ross, J. S., Amendt, P., Atherton, L. J., Dunne, M., Glenzer, S. H., Lindl, J. D., Meeker, D., Moses, E. I., Nikroo, A., Wallace, R.
  2013; 3
- **LIFE: THE CASE FOR EARLY COMMERCIALIZATION OF FUSION ENERGY** *FUSION SCIENCE AND TECHNOLOGY*
  Anklam, T. M., Dunne, M., Meier, W. R., Powers, S., Simon, A. J.
  2011; 60 (1): 66-71
- **LIFE PURE FUSION TARGET DESIGNS: STATUS AND PROSPECTS** *FUSION SCIENCE AND TECHNOLOGY*
  Amendt, P., Dunne, M., Ho, D. D., Lindl, J. D.
  2011; 60 (1): 49-53
- **TIMELY DELIVERY OF LASER INERTIAL FUSION ENERGY (LIFE)** *FUSION SCIENCE AND TECHNOLOGY*
  Dunne, M., Moses, E. I., Amendt, P., Anklam, T., Bayramian, A., Bliss, E., Debs, B., DERI, R., de la Rubia, T. D., El-Dasher, B., Farmer, J. C., Flowers, D., Kramer, et al
  2011; 60 (1): 19-27

- **COMPACT, EFFICIENT LASER SYSTEMS REQUIRED FOR LASER INERTIAL FUSION ENERGY** *FUSION SCIENCE AND TECHNOLOGY*
  Bayramian, A., Aceves, S., Anklam, T., Baker, K., Bliss, E., BOLEY, C., Bullington, A., Caird, J., Chen, D., DERI, R., Dunne, M., Erlandson, A., Flowers, et al
  2011; 60 (1): 28-48

- **Investigations of laser-driven radiative blast waves in clustered gases**
  Symes, D. R., Hohenberger, M., Lazarus, J., Osterhoff, J., Moore, A. S., Faeustlin, R. R., Edens, A. D., Doyle, H. W., Carley, R. E., Marocchino, A., Chittenden, J. P., Bernstein, A. C., Gumbrell, et al
  ELSEVIER SCIENCE BV.2010: 274–79

- **Fusion's bright new dawn** *PHYSICS WORLD*
  Dunne, M.
  2010; 23 (5): 28–33

- **The New Fast Ignitor Oriented Target Area in the Vulcan Laser at the CLF** *2nd International Conference on Ultra-Intense Laser Interaction Science*
  Galimberti, M., Bandyopadhyay, S., Bickerton, R., Blake, S., Burton, C., Clarke, R., Collier, J., Dubrovsky, V., Dunne, M., Frackiewicz, A., Hancock, S., Heathcote, R., Hernandez-Gomez, et al
  AMER INST PHYSICS.2010: 35–38

- **Recent fast electron energy transport experiments relevant to fast ignition inertial fusion** *NUCLEAR FUSION*
  Norreys, P. A., Scott, R. H., Lancaster, K. L., Green, J. S., Robinson, A. L., Sherlock, M., Evans, R. G., Haines, M. G., Kar, S., Zepf, M., Key, M. H., King, J., Ma, et al
  2009; 49 (10)

- **Full-trajectory diagnosis of laser-driven radiative blast waves in search of thermal plasma instabilities** *PHYSICAL REVIEW LETTERS*
  Moore, A. S., Gumbrell, E. T., Lazarus, J., Hohenberger, M., Robinson, J. S., Smith, R. A., Plant, T. A., Symes, D. R., Dunne, M.
  2008; 100 (5): 055001

- **Relativistic laser-matter interaction: from attosecond pulse generation to fast ignition**
  Mourou, G. A., Labaune, C. L., Dunne, M., Naumova, N., Tikhonchuk, V. T.
  IOP PUBLISHING LTD.2007: B667–B675

- **A route to the brightest possible neutron source?** *SCIENCE*
  Taylor, A., Dunne, M., Bennington, S., Ansell, S., Gardner, I., Norreys, P., Broome, T., Findlay, D., Nelmes, R.
  2007; 315 (5815): 1092–95

- **Investigating the astrophysical applicability of radiative and non-radiative blast wave structure in cluster media**
  Moore, A. S., Lazarus, J., Hohenberger, M., Robinson, J. S., Gumbrell, E. T., Dunne, M., Smith, R. A.
  SPRINGER.2007: 139–45

- **Colliding blast waves driven by the interaction of a short-pulse laser with a gas of atomic clusters**
  Smith, R. A., Lazarus, J., Hohenberger, M., Moore, A. S., Robinson, J. S., Gumbrell, E. T., Dunne, M.
  SPRINGER.2007: 131–37

- **Laser-driven particle accelerators** *SCIENCE*
  Dunne, M.
  2006; 312 (5772): 374–76

- **A high-power laser fusion facility for Europe** *NATURE PHYSICS*
  Dunne, M.
  2006; 2 (1): 2–5

- **Multimode seeded Richtmyer-Meshkov mixing in a convergent, compressible, miscible plasma system**
  Lanier, N. E., Barnes, C. W., Batha, S. H., Day, R. D., Magelssen, G. R., Scott, J. M., Dunne, A. M., Parker, K. W., Rothman, S. D.
  AMER INST PHYSICS.2003: 1816–21

- **Observation of mix in a compressible plasma in a convergent cylindrical geometry** *PHYSICS OF PLASMAS*
  Barnes, C. W., Batha, S. H., Dunne, A. M., Magelssen, G. R., Rothman, S., Day, R. D., Elliott, N. E., Haynes, D. A., Holmes, R. L., Scott, J. M., Tubbs, D. L., Youngs, D. L., Boehly, et al
  2002; 9 (11): 4431–34

- **Direct observation of strong coupling in a dense plasma** *PHYSICAL REVIEW E*
  Riley, D., Weaver, McSherry, D., Dunne, M., Neely, D., Notley, M., Nardi, E.
  2002; 66 (4): 046408

- **Indirect-drive inertial confinement fusion using highly supersonic, radiatively cooled, plasma slugs** *PHYSICAL REVIEW LETTERS*
  Chittenden, J. P., Dunne, M., Zepf, M., Lebedev, S. V., Ciardi, A., Bland, S. N.
  2002; 88 (23)

- **AWE experimental laser plasma program** *5th Zababakhin Scientific Meeting*
  Dunne, M., Edwards, J., Graham, P., Evans, A., Rothman, S., Smedley-Stevenson, R., Barnes, C. W., Hsing, W., Goldman, S. R.
  CAMBRIDGE UNIV PRESS.2000: 213–18

- **Production of enhanced pressure regions due to inhomogeneities in inertial confinement fusion targets**
  Goldman, Barnes, C. W., Caldwell, S. E., Wilson, D. C., Batha, S. H., Grove, J. W., Gittings, M. L., Hsing, W. W., Kares, R. J., Klare, K. A., Kyrala, G. A., Margevicius, R. W., Weaver, R. P., et al
  AMER INST PHYSICS.2000: 2007–13

- **Turbulent hydrodynamics experiments using a new plasma piston**
  Edwards, J., Glendinning, S. G., Suter, L. J., Remington, B. A., Landen, O., Turner, R. E., Shepard, T. J., Lasinski, B., Budil, K., Robey, H., Kane, J., Louis, H., Wallace, et al
  AMER INST PHYSICS.2000: 2099–2107

- **Shock structuring due to fabrication joints in targets** *PHYSICS OF PLASMAS*
  Goldman, Caldwell, S. E., Wilke, M. D., Wilson, D. C., Barnes, C. W., Hsing, W. W., Delamater, N. D., Schappert, G. T., Grove, J. W., Lindman, E. L., Wallace, J. M., Weaver, R. P., Dunne, A. M., et al
  1999; 6 (8): 3327–36

- **Computational study of laser imprint mitigation in foam-buffered inertial confinement fusion targets** *PHYSICS OF PLASMAS*
  Mason, R. J., Kopp, R. A., Vu, H. X., Wilson, D. C., Goldman, Watt, R. G., Dunne, M., Willi, O.
  1998; 5 (1): 211–21

- **EVALUATION OF A FOAM BUFFER TARGET DESIGN FOR SPATIALLY UNIFORM ABLATION OF LASER-IRRADIATED PLASMAS** *PHYSICAL REVIEW LETTERS*
  DUNNE, M., BORGHESI, M., IWASE, A., JONES, M. W., TAYLOR, R., GIBSON, R., GOLDMAN, MACK, J., WATT, R. G.
  1995; 75 (21): 3858–61

- **USE OF X-RAY PREHEATED FOAM LAYERS TO REDUCE BEAM STRUCTURE IMPRINT IN LASER-DRIVEN TARGETS** *PHYSICAL REVIEW LETTERS*
  DESSELBERGER, M., JONES, M. W., EDWARDS, J., DUNNE, M., WILLI, O.
  1995; 74 (15): 2961–64

- **SUPERSONIC PROPAGATION OF AN IONIZATION FRONT IN LOW-DENSITY FOAM TARGETS DRIVEN BY THERMAL-RADIATION** *PHYSICAL REVIEW LETTERS*
  AFSHARRAD, T., DESSELBERGER, M., DUNNE, M., EDWARDS, J., FOSTER, J. M., HOARTY, D., JONES, M. W., ROSE, S. J., ROSEN, P. A., TAYLOR, R., WILLI, O.
  1994; 73 (1): 74–77

- **EXPERIMENTAL-OBSERVATIONS OF THE EXPANSION OF AN OPTICAL-FIELD-INDUCED IONIZATION CHANNEL IN A GAS-JET TARGET** *PHYSICAL REVIEW LETTERS*
  DUNNE, M., AFSHARRAD, T., EDWARDS, J., MACKINNON, A. J., VIANA, S. M., WILLI, O., PERT, G.
  1994; 72 (7): 1024–27

- **EXPERIMENTAL-MEASUREMENT OF THE DYNAMICS OF FOIL TARGETS UNDER THE IMPACT OF INTENSE PULSES OF SOFT-X RADIATION** *PHYSICAL REVIEW LETTERS*
  EDWARDS, J., DUNNE, M., TAYLOR, R., WILLI, O., BACK, C. A., ROSE, S. J.
  1993; 71 (21): 3477–80

- **TIME RESOLVED SOFT-X-RAY IMAGING WITH SUBMICRON SPATIAL-RESOLUTION (INVITED)**
  WILLI, O., AFSHARRAD, T., DESSELBERGER, M., DUNNE, M., EDWARDS, J., KHATTAK, F., TAYLOR, R.
  AMER INST PHYSICS.1992: 4818–22

- **TIME-RESOLVED MEASUREMENT OF X-RAY HEATING IN PLASTIC FOILS IRRADIATED BY INTENSE SOFT-X-RAY PULSES** *PHYSICAL REVIEW LETTERS*

  EDWARDS, J., DUNNE, M., RILEY, D., TAYLOR, R., WILLI, O., ROSE, S. J.

  1991; 67 (27): 3780–83