


Stanford



Mike Dunne

Professor of Photon Science

Photon Science Directorate

 Resume available Online

CONTACT INFORMATION

- **Administrative Contact**

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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)

PATENTS

- Mike Dunne. "United States Patent 11387007 Inertial Confinement Fusion system which decouples life-limited components from plant availability", Lawrence Livermore National Security, LLC, Jul 12, 2022

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)

Sathya Ranjan Chitturi, Jack Hirschman, Axel Levy, Nan Wang

Publications

PUBLICATIONS

- **Inertial Confinement Fusion Power Plants** *Encyclopedia of Nuclear Energy*
Dunne, M., Anklam, T., Meier, W.
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- **X-ray free-electron lasers light up materials science** *NATURE REVIEWS MATERIALS*
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White, W. E., Robert, A., Dunne, M.
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- **Femtosecond-Terawatt Hard X-Ray Pulse Generation with Chirped Pulse Amplification on a Free Electron Laser.** *Physical review letters*
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- **A machine learning photon detection algorithm for coherent x-ray ultrafast fluctuation analysis** *STRUCTURAL DYNAMICS-US*
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- **Automated prediction of lattice parameters from X-ray powder diffraction patterns** *JOURNAL OF APPLIED CRYSTALLOGRAPHY*
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- **Automated prediction of lattice parameters from X-ray powder diffraction patterns.** *Journal of applied crystallography*
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- **Generation of highly mutually coherent hard-x-ray pulse pairs with an amplitude-splitting delay line** *PHYSICAL REVIEW RESEARCH*
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- **Realizing split-pulse x-ray photon correlation spectroscopy to measure ultrafast dynamics in complex matter** *PHYSICAL REVIEW RESEARCH*
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- **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.
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- **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.
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- **LIFE PURE FUSION TARGET DESIGNS: STATUS AND PROSPECTS** *FUSION SCIENCE AND TECHNOLOGY*
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- **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
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- **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
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Dunne, M.
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- **TIME-RESOLVED MEASUREMENT OF X-RAY HEATING IN PLASTIC FOILS IRRADIATED BY INTENSE SOFT-X-RAY PULSES** *PHYSICAL REVIEW LETTERS*
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