ICFO COLLOQUIUM JUSTIN WARK 'Extreme States of Matter Created with 4th-Generation Light Sources'

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JUSTIN WARK

Professor of Physics, Trinity College and Director of the Oxford Centre for High Energy Density Science (OxCHEDS)

$$Justin Wark received his degree in physics from the University of Oxford in 1982, and his Ph.D. in plasma physics from Imperial College in 1985. He was awarded a Royal Society University Research Fellowship at the University of Oxford, where he set up a research group working in high power laser-matter interactions. His research includes high harmonic generation, XUV lasers, x-ray spectroscopy, and the development and use of novel x-ray sources in studying shock and isentropic compression of solid-state matter via x-ray diffraction. His research group has recently been highly active in exploiting so-called 4th

generation light sources - XUV and X-Ray Free Electron Lasers which have a spectral brightness over a billion times greater than those of any synchrotron. He has used such sources to both create and diagnose matter under extremes of density, temperature, and pressure. He is currently a fellow, tutor and professor of physics at Trinity College, Director of the Oxford Centre for High Energy Density Science (OxCHEDS), and a Fellow of APS.
Just under a decade ago, in the course of a single morning as the 100 metres of undulators were aligned with micron precision, the spectral brightness of man-made x-ray sources increased by a factor of a billion as a new machine, the LCLS X-Ray Free Electron Laser, started operation. Since that time this so-called "4th generation light source" has had immense impact across many scientific disciplines. In this talk I will outline the revolution it is starting to have in "extreme physics?, where for periods of time ranging from a few femtoseconds to nanoseconds we can create and diagnose, in a controlled manner, matter that is similar to that which exists half way to the centre of the sun, or towards the centre of giant planets. Whilst significant progress has been made over the past decade, further advances are imminent as a result of a beam line at the newly operational European XFEL that will allow such extreme states to be produced at high repetition rates.