Godfrey Stafford Celebration

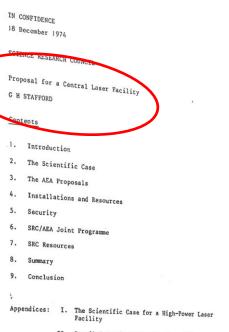
The Central Laser Facility

Prof John Collier Director





Origins



100

II. Detailed Requirements of a Central Laser Facility

1

179776 KH 1/73 90 JET

Science Research Council

3 October 1975

High Holborn London WC1 01-242 1262

PRESS NOTICE

SCIENCE RESEARCH COUNCIL CENTRAL LASER FACILITY

use by university research scientists.

estimated at £5.7 million.

to continue.

The Council announces that it is to provide central laser facilities for

The Government has given approval for the Science Research Council to

Council's Rutherford Laboratory at Chilton, Oxfordshire. The equipment will be a versatile neodynium glass laser system and comprehensive diagnostic and experimental equipment costing altogether

provide a high power laser and ancillary equipment for use by university and polytechnic research groups. The facilities will be set up at the

about £1 million. There will also be a full programme of laser development on the basis of which further facilities may be provided. The total cost of the provision and operation of the facilities over the next six years is

The necessary staff will be provided by the Rutherford Laboratory to set up and operate the facility, to undertake the study of new laser systems and to provide the engineering and administrative support for the university groups. Plans for the projects were drawn up by a Steering Committee under the Chairmannhip of Projectsor D J Bradley (Imperial College, London) and arrancement are being made for close computation with operating up

In Confidence

SCIENCE RESEARCH COUNCIL

--000-

Proposal for an S.R.C. central laser facility for the

production and study of high-density plasma

-000-

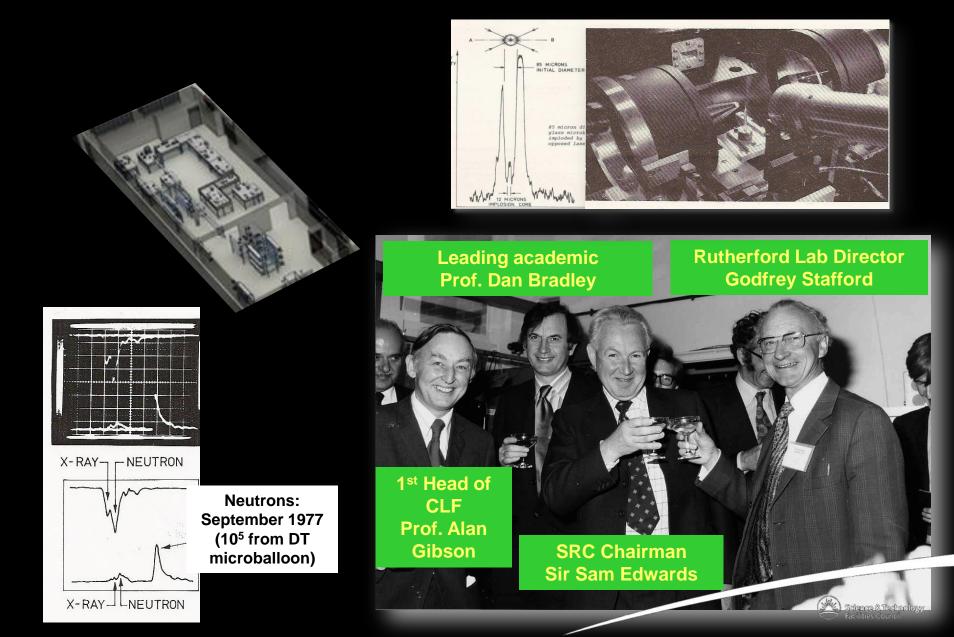
SRC 107-74

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4

Vulcan Laser Facility (1977)



Vulcan – Today – 37 years on....



WORLD MOST POWERFUL LASER FACILITY

Can generate an optical pulse with a power of 1 PW (10,000x Natl. Grid) and intensity of 10 ²¹ W/cm²

Why the interest...?

- Vulcan can recreate the conditions of many astrophysical objects
- Squeeze matter together at exceptionally high pressures to extraordinary density e.g. Jupiter, Earth
- Heat matter to temperatures of the sun
- Drive fusion reactions

USA National Ignition Facility

System to demonstrate inertial confinement fusion
UK has contributed much via CLF, academia and AWE over the years
Many of its top people have come through CLF

NIF-0506-11956

Inertial Fusion Energy - HiPER



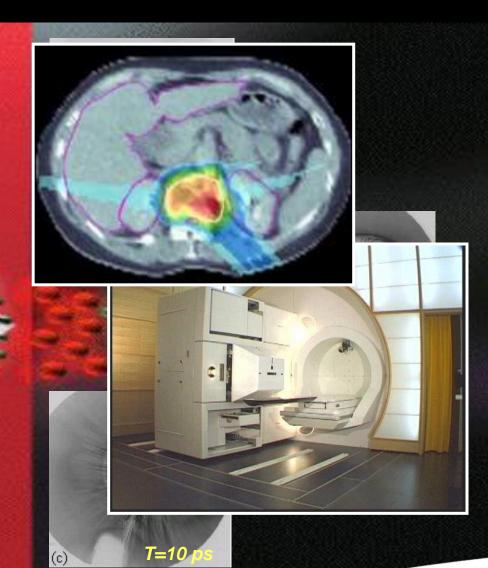


CLF is leading the European HiPER Project
Promoting the establishment of a European wide programme of R&D for laser then Inertial Fusion Energy



Relativistic Interactions

 Extreme intensities drive relativistic processes • E.G. lons can be driven forwards to very high energy ~100 MeV in 1μm Plasma imaging, oncology?





Engineering and Physical Sciences Research Council

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www.clf.rl.ac.uk

Queen's University

Belfast

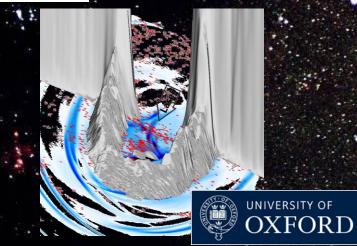
Science & Technology Facilities Council

Future - Vulcan 20 PW

Vacuum 4 Wave mixing



<u>'Micro-laboratory' for e+/e-/γ</u> plasma





Next generation of Vulcan will be so powerful as to measurably perturb the vacuum
"QED" research was mentioned in the original case
Enable IFE development



CLF's Gemini Facility – New Applications

- Vulcan success spawned other facilities
- Today we have the Gemini Facility
 Worlds first dual beam PW facility
 Worlds first high repetition rate PW



Table Top Accelerators

Imperial College London

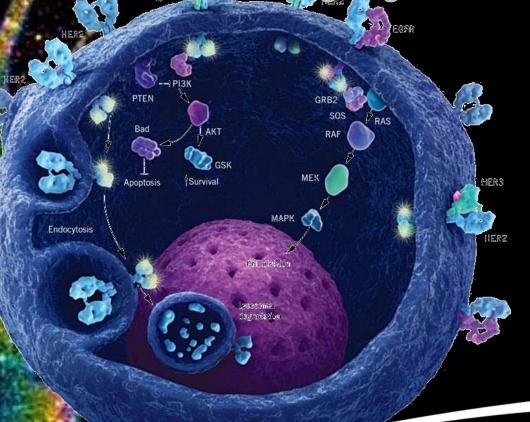


Engineering and Physical Sciences Research Council

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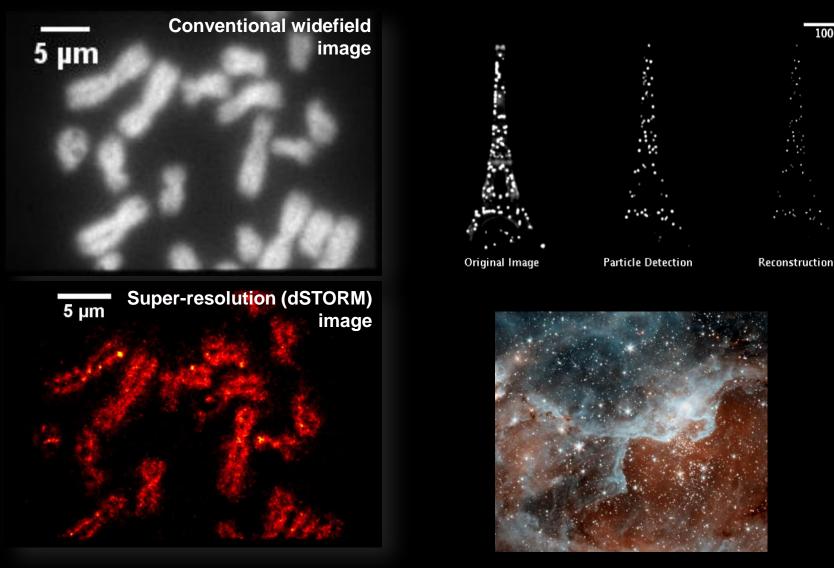
Lasers & Life Science CLF has developed facilities in the new cross council Research Complex to peer deep inside cells to reveal their internal workings – fundamental to under tanding e.g. cancer



CLF Octopus Facility



Super-resolution Imaging









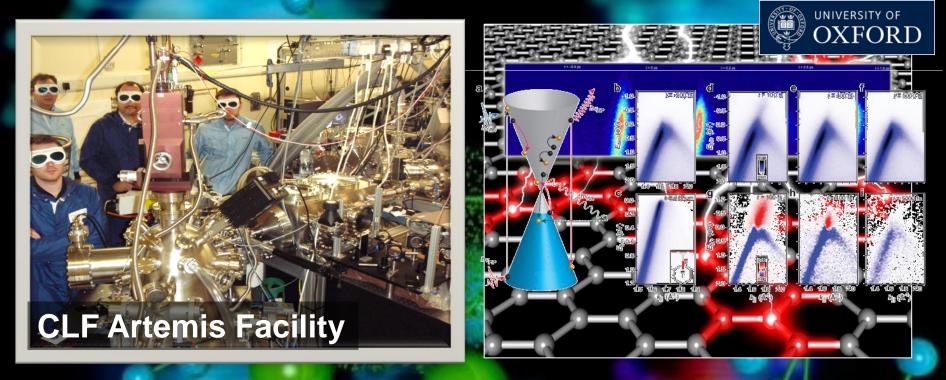


UCL



100 m

CLF Lasers for extreme dynamics (as)



Graphene has unique optical properties, that could lead to many applications in optoelectronics
Recent CLF experiments have made first direct measurements of electron dynamics
Shown "population inversion" i.e. potential laser in THz regime and potential solar cell use

CLF Innovation Example - Aviation Security



Will be widely seen in airports around the world from 2014 Specialist lasers, invented at CLF, can "see through" plastic & glass bottles

Patented & commercialised as liquid explosives detector
Will have major impact on airport security and our travel
no more 100 ml



Even seeing through skin

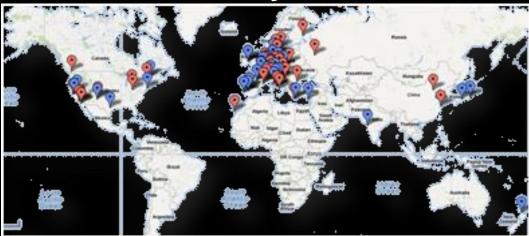


- Osteoporosis affects 1 in 3
 women over 50
- Undiagnosed cases cost the NHS more than £1 Billion per annum
- Clinical trials are underway to see through skin to diagnose bone conditions
- This uses the CLF patented techniques

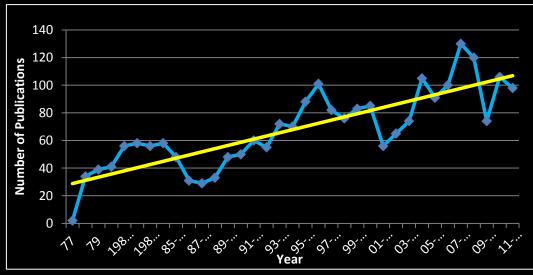


Since 1977

Global Community



Scientific Diversity & Excellence



Economic Innovation





Godfrey Stafford's legacy...

