Cockcroft Institute, University of Liverpool

Department Name:

Supervisor(s) and their email address (2 max):

Professor James Bradley (j.w.bradley@liv.ac.uk) and Dr Reza Valizadeh (reza.valizadeh@stfc.ac.uk)

Funding Status (select from below drop down menu):

Directly Funded Project (Students Worldwide)

Application Deadline:

31/12/2017

Project Title:

Plasma technology for the production of superconducting thin films in accelerator applications
The Cockcroft Institute - a collaboration between academia, national laboratories, and industry - brings together the best scientists and engineers to conceive, construct and exploit particle accelerators of all sizes, and to lead the UK’s participation in flagship international facilities. We are offering a fully funded three year PhD studentship to study the physics and utilization of ultra-high power pulsed-plasma technology for the deposition of superconducting thin films in accelerator cavity applications.

Reducing the cost of conventional niobium superconducting RF cavities, whilst retaining high field gradient performance, has been of considerable interest to the international accelerator community. A promising solution is to deposit superconducting thin films on copper cavities which have a high thermal conductivity.

This PhD research project will concentrate on the development, diagnosis and implementation of a new type of plasma-based method that utilizes ultra-high energy pulses, to sputter-deposit superconducting thin films on 2-D and complex 3-D geometries. An array of different thin films may be considered in the project, for instance Nb, NbN, Nb3Sn, Nb3Ti and Mg2B.

This new plasma technology provides much higher metal ion fractions than is possible in conventional sputtering and has the feature that ions are accelerated out radially from the source, making them an ideal candidate to deposit thin films inside the interior of narrow RF accelerator cavities.

The PhD has three strongly interlinked elements. It involves 1) the study of the physics of the plasma source through advanced optical and electrical measurements, 2) the use of the plasma source to produce high-quality superconducting thin films and 3) the surface analysis of the thin film properties and testing of their superconducting performance.

The ultimate aim is to be able to control the production processes of the energetic ions in the plasma to achieve the desired lateral film coverage rates, uniformity and film properties, namely ultra-low electrical resistivities and extremely high quality Q factors of the composite cavities.

The PhD programme will provide the opportunity for the student to work in two world-class laboratories: the plasma laboratory at University of Liverpool to undertake the plasma physics study and the ASTeC group laboratory at Daresbury to undertake the thin film deposition and characterisation studies. In this way, the student will benefit from working across two close-by institutes, learning a wide range of different skills.


References (optional):

This is a 3-year fully-funded studentship open to UK (home) and EU nationals that covers: (i) a tax-free annual studentship at the standard Research Council rate (£14,764 for 2018/19), (ii) tuition fees at the UK/EU rate and (iii) a contribution towards consumables and travel. Overseas students (from non-EU countries) are eligible to apply but only UK/EU fees will be awarded, requiring the student to provide the funding shortfall.

Funding Notes (max 100 words):

Professor James Bradley

j.w.bradley@liv.ac.uk

Name and email address to direct enquiries to:

Application Web Page:
List of subject areas (please select the appropriate subject areas the project applies to):

**Engineering**
- Acoustics
- Aeronautical Engineering
- Biomedical Engineering
- Chemical Engineering
- Civil & Structural Engineering
- **Electrical & Electronic**
- Energy
- Manufacturing
- **Materials Science**
- Mechanical Engineering
- Nanotechnology
- Nuclear Engineering
- Semiconductors
- Software Engineering
- Telecommunications

**Maths & Computing**
- Applied Mathematics
- Bioinformatics
- Computational Chemistry
- **Computer Science & IT**
- Data Analysis
- Information Science
- Mathematics
- Operational Research
- Software Engineering
- Statistics

**Humanities**
- American Studies
- Anthropology
Archaeology
Architecture & the Built Environment
Asian Studies
Classics & Ancient History
Communication, Cultural & Media Studies
European Studies
Geography
History
Middle East & African Studies
Modern Languages & Linguistics
Philosophy
Theology & Religious Studies

Social Science & Health
American Studies
Anthropology
Architecture & the Built Environment
Asian Studies
Development Studies
Economics
Education
European Studies
Gender & Sexuality
Geography
Health Sciences
History
Middle East & African Studies
Modern Languages & Linguistics
Nursing, Midwifery & Allied Health Professions
Philosophy
Political Science & International Studies
Psychology
Public Health & Epidemiology
Social Work, Social Policy & Administration
Sociology
Sports, Recreation & Leisure Studies
Town & Country Planning

Business & Finance
Biological & Medical Sciences

- Agricultural Sciences
- Biochemistry
- Bioinformatics
- Biomedical Engineering
- Biophysics
- Biotechnology
- Botany / Plant Science
- Cancer / Oncology
- Cell Biology / Development
- Dentistry
- Ecology & Conservation
- Endocrinology
- Evolution
- Food Science / Nutrition
- Genetics
- Immunology
- Marine Biology
- Medical / Biomedical Physics
- Medical / Clinical Science
- Microbiology
- Molecular Biology
- Neuroscience / Neurology
- Obstetrics, Gynaecology & Reproduction
- Parasitology
- Pathology
- Pharmacology / Toxicology
- Physiology & Sports Science
- Psychology & Psychiatry
- Public Health & Epidemiology
- Structural Biology
- Veterinary Medicine
- Virology
- Zoology / Animal Science

Chemical Sciences

- Agricultural Chemistry

Accounting & Finance
- Business & Management
- Economics
- Tourism & Hospitality

Law
- Law

Arts
- Architecture & the Built Environment
- Art & Design
- Classics & Ancient History
- Drama, Dance & Performing Arts
- English
- History
- Music
Earth Sciences

- Agronomy & Soil Science
- Atmospheric Physics
- Climatology & Climate Change
- Ecology & Conservation
- Ecotoxicology & Pollution
- Environmental Chemistry
- Environmental Science
- Geochemistry
- Geography
- Geology
- Geophysics
- Hydrology
- Meteorology
- Oceanography