Trinity College Dublin
The University of Dublin

CRANN

PhD position in atomistic simulations for novel spintronic devices

One fully-funded four-year PhD position is available from April 2020 in the School of Physics and the CRANN Institute at Trinity College Dublin (Ireland). It is possible also to defer the start of the PhD student until the September registration, if required. Sponsored by the Science Foundation of Ireland (SFI), this is part of a Starting Investigator Research Grant awarded to Dr. Maria Stamenova for the ATMOST project which is commencing in April 2020. The PhD training will benefit from close interaction with the Computational Spintronics Group, headed by Prof. Stefano Sanvito (who is also a mentor and co-supervisor of the PhD project). The new ATMOST project is also strongly connected with the experimental activity at CRANN and the AMBER research center. Strong collaborations with the NPL, the University of York and the QUB, including training visits for the PhD student, are explicitly included in the research plan.

The ATMOST project:
Atomistic theory and simulations for THz spintronic devices

The THz range of the electromagnetic spectrum (high-frequency microwaves) is the domain of important chemical and biological processes. Importantly, the THz range is expected to host the short-range, high-bandwidth telecommunications of the future. With ATMOST we seek to develop a multi-scale theory for modelling and optimising THz spintronic oscillators based on magnetic tunnel junctions (MTJs) incorporating novel antiferromagnetic (AFM) or low-moment ferrimagnetic (FiM) materials.

We will combine *ab initio* electronic structure theory (at the level of the density functional theory) for evaluating atomically-resolved material parameters and for modelling the spin transport in the MTJs (calculating from first principles current-induced spin-transfer/orbit torques (STT/SOT), via the non-equilibrium Green's function method), and time-domain spin dynamics simulations at the level of the classical atomistic spin dynamics (ASD) scheme (akin to the micro-magnetic simulations but with atomistic discretisation). Typically exploited for manipulating magnetic order (e.g. switching bits in STT-MRAM), the STT/SOT can also be tuned to excite and sustain magnetisation precession or oscillations accompanied by electromagnetic radiation, which for AFM/FiM oscillators can be in the THz range. Our aim is to realise a broader-scoped multi-scale simulation technique for current-induced spin-dynamics in novel MTJs to guide their design and optimisation for spintronic applications. In this effort we envisage collaborations with leading groups at the multiple levels of theory involved, as well as close collaboration with the experimental groups of Prof. Coey and Prof. Stamenov in Trinity who are currently actively researching novel THz spintronic oscillators.

Trinity College Dublin
The University of Dublin

CRANN

General rules for PhD students: eligibility and admission

The School of Physics runs graduate programmes for PhD and MSc degrees by research only, with two admission periods, October to September and April to March. More details and all the relevant deadlines can be found on the Trinity College Dublin Graduate Studies web page for prospective students and additional information for this position is available on the School of Physics web page.

The minimum entry to the School of Physics (TCD) postgraduate program is a 2.1 honours degree from an Irish university or equivalent. The student should be fluent in the English language (certificate required for international students).

Financial aspects

Tuition fees for the 4-year PhD programme will be completely covered for an EU/UK citizen and a stipend exempt from taxation paid monthly for the duration of the PhD. Free medical care is accessible at the Trinity College Health Centre for all postgraduate students.

Essential/Desirable Criteria

Strong overall motivation, a demonstrated interest in condensed matter theory and computation and a Bachelor degree (or equivalent) in Physics. Ability to work independently and also function as an active and efficient team player. Good writing and communication skills. EU/UK citizenship is required due to budget restriction for the tuition fees. Previous experience in UNIX/Linux environment, programming skills in Fortran/C/C++ and basic knowledge of density functional theory and/or electronic structure methods will be considered as an advantage.

How to apply?

Applications must include a motivation letter and a brief statement of candidate's eligibility (the admission criteria are described above), together with a CV, recent academic transcript (if not yet graduated) and the name & contact details of at least two referees (e-mail addresses).

For informal queries and to apply email Dr. M. Stamenova (Trinity College Dublin): stamenom@tcd.ie

The position will be open until filled. First round of shortlisted candidates will be interviewed by end of February.

Trinity College Dublin, the University of Dublin is an equal opportunities employer and is committed to the employment policies, procedures and practices which do not discriminate on grounds such as gender, civil status, family status, age, disability, race, religious belief, sexual orientation or membership of the travelling community.

Trinity College Dublin

Trinity College Dublin is Ireland's university on the world stage. Recognized for its transformative research and education conducted at the frontiers of disciplines, Trinity is ranked 61st in the world by the QS World University Rankings 2013. Spread across 47 acres in Dublin's city centre, Trinity has a 17,000-strong student body, 3,000 staff and over 100,000 alumni around the world. Of the student body, 16% come from outside Ireland and, of those, 40% are from outside the European Union, making Trinity's campus cosmopolitan and bustling, with a focus on diversity. Trinity has developed significant strength in a broad range of research areas, including the 21 broadly based multi-disciplinary thematic research areas.
See www.tcd.ie/research/themes.

CRANN

CRANN, the Centre for Research on Adaptive Nanostructures and Nanodevices (www.tcd.ie/crann), is Ireland's first purpose-built research institute. CRANN is focused on delivering world-class research and innovation through extensive proactive collaborations with industry and is committed to attracting and training graduate students to the highest international standards. CRANN works at the frontiers of nanoscience developing new knowledge of nanoscale materials, with a particular focus on new device and sensor technologies for ICT, the biotechnology and medical technology sectors and a growing interest in energy related research. The institute employs a team of over 300 researchers from 45 different countries, led by 30 principal investigators, each of whom is an internationally recognized expert in their field of research, which include physics, chemistry, medicine, biochemistry and immunology, engineering and pharmacy.
Since its inception in 2003, CRANN has greatly assisted in radically transforming Ireland's international reputation for research. A Thomson Reuters report in late 2010 placed Ireland 8th globally for materials science research based on citations per publication for the decade 2000-2010. CRANN researchers were responsible for > 70% of the outputs leading to this national ranking. In Nanotechnology, Ireland's global ranking is sixth in terms of both the quality of its publications and the volume output per capita.

AMBER

AMBER (Advanced Materials and BioEngineering Research - ambercentre.ie) is a world-leading SFI Research Centre funded by Science Foundation Ireland, hosted by Trinity College Dublin which provides a partnership between leading researchers in materials science and industry to develop new materials and devices for a range of sectors, particularly the ICT, medical devices and industrial technology sectors. Working in collaboration with CRANN (Trinity's Centre for Research on Adaptive Nanostructures and Nanodevices), the Trinity Centre for Bioengineering and with University College Cork and the Royal College of Surgeons in Ireland.