



Job Details

Job Title:	PhD Studentship (Marie Skłodowska-Curie Early-Stage Researcher)	
School:	Mathematics	
Reports to:	Prof. Tristan McLoughlin	
Grade:	Off-scale	Full Time
Appointment period:	3 years (36 months)	
Current Location:	Hamilton Building, Trinity College Dublin	
Closing date:	June 29 th 2018	
Applications to:	Prof. Tristan McLoughlin, sagex@maths.tcd.ie	

The successful candidate will be expected to take up post on August 31st 2018 or as soon thereafter as possible.

Job Description

An Early-Stage Researcher (ESR) / PhD position has become available in the vibrant area of Scattering Amplitudes. These ESR positions are part of the Marie Skłodowska-Curie Innovative Training Network “SAGEX” (*Scattering Amplitudes: from Geometry to Experiment*), based at the School of Mathematics, Trinity College Dublin. The position will be under the supervision of Prof. Tristan McLoughlin

Trinity is Ireland’s premier university, with a proud tradition of excellence stretching back to its foundation in 1592. The oldest university in Ireland, and one of the oldest in Europe, today Trinity sits at the intersection of the past and the future, and is ideally positioned as a major university in the European Union. Our 47-acre campus is located in the heart of Dublin city centre and is home to historic buildings dating from the University’s establishment, as well as some of the most cutting-edge teaching and research facilities in Ireland. Students at Trinity benefit from a unique educational experience across a range of disciplines in our three faculties – Arts, Humanities, and Social Sciences; Engineering, Mathematics and Science; and Health Sciences. The pursuit of excellence through research and scholarship is at the heart of a Trinity education, and our researchers have an outstanding publication record and strong record of grant success.

The School of Mathematics at TCD has an excellent international reputation with particular research strengths in a number of areas of Theoretical Physics including Quantum Field Theory, String Theory, Lattice QCD and Integrable Models.

General description of the research area and of SAGEX:

Scattering amplitudes provide a window into the fundamental structures predicted by relativistic quantum theories. By identifying and exploiting seemingly disparate concepts from abstract geometry, symbolic big data, and phenomenological calculations, the SAGEX network will train the next generation of researchers in the new tools, approaches and



Trinity College Dublin

Coláiste na Tríonóide, Baile Átha Cliath

The University of Dublin

insights that will make possible previously intractable analyses directly relevant to current and near-future particle physics experiments.



Assembling an unprecedented team of top scholars in mathematics, theoretical physics, and symbolic computation with major industry partners including Wolfram Research, Maplesoft, and RISC GmbH, we intend to leverage our successes, expertise, and world-class scientific challenges to provide a unique training opportunity for Early Stage Researchers (ESRs) in Europe.

Training of the network's ESRs will comprise an integrated curriculum of local and intensive network courses, schools, and engagement with active cutting-edge research. They will be seconded to at least one academic and one private sector partner of the project, building bridges between academic and industrial communities. SAGEX is set up to integrate several existing and highly recognised annual conferences with a series of new schools, workshops and industry partnerships. Through developing invaluable analytic, computational and soft skills, the ESRs emerging from this action will be eminently employable with the potential to become the next generation of European leaders in academia, industry, and the public sector. Finally, the training we offer, and the research carried out, will be made open and available, boosting not only Europe's continued leadership in the field of high-energy theoretical physics, but strategically allowing non-partner institutions with less domain experience to train scholars in relevant, in-demand skills.

The post-holder will contribute to research investigations in collaboration with and under the supervision of Prof. Tristan McLoughlin in order to realise the objectives and development of the Marie Skłodowska-Curie European Innovative Training Network SAGEX.

Outline of the ESR position

Soft limits and symmetries in perturbative gauge theory and gravity

Objectives: How can the symmetries of gauge and gravitational theories can be used to constrain the form of amplitudes and form factors? Spontaneously broken symmetries are related to universal limits of amplitudes where one or more of the particles becomes soft. Our aim is to have a transparent formulation of the connection between symmetries and soft limits in a broad context of quantum field theories. A specific goal will be to understand to what extent such soft limits can be used to determine complete amplitudes in $N = 4$ SYM and $N = 8$ supergravity, first at tree and then loop level.

Milestones and expected results: First, find a relation between double-soft limits and asymptotic symmetry algebra for gauge bosons and gravitons for tree amplitudes; next extend these results to loop level and develop a generalised “inverse-soft” construction of amplitudes.

Planned Secondments: Three months to Maplesoft; short term visits to other partners (HU, UCLA). Further secondment at Danske Bank, DreamQuark, Mærsk, or Milde Marketing.



Duties and Responsibilities

The main duties and responsibilities of the position include:

1. Contributing towards the SAGEX research programme, which has been conceived to advance our understanding of scattering amplitude taking responsibilities for a programme a work under the general supervision of Professors Brandhuber and Travaglini.
2. Conduct research as required by the broad aims of the research project.
3. Provide and prepare data essential for grant progress reports.
4. Maintaining appropriate databases, keeping accurate written and computerised records and to ensure that these records are stored in a secure place, and to maintain confidentiality of all electronically stored personal data in line with the provisions of the General Data Protection Regulation .
5. Prepare reports of appropriate research results for public presentation through seminars and conferences. Contribute to writing papers summarising research findings for publication in peer-reviewed journals (of high international standing where possible). Contribute to other reports where possible.
6. Undertaking literature and database searches for the research project, and to be able to interpret and present the findings of the literature searches and advise the research teams appropriately regarding potential projects as required by Supervisors.
7. Keeping up to date with subject-related and professional issues, in particular, developments in the specific subject area.
8. Attending any other relevant activities such as local/network training courses (including soft skills), schools and workshops related to the project as appropriate.
9. Taking part in outreach and outreach training as required by the project.
10. Collaborating with other members of the research group on the research project and beyond research team where needed, including other academics and industrial collaborators.
11. Develop, in collaboration with the Supervisors, such new techniques as may be necessary to achieve the objectives of the research.
12. Make research contributions to the research programme wherever possible, and to contribute freely to the team research environment in a manner conducive to the success of the research project as a whole.
13. To show a professional attitude to matters of office hygiene, organisation and safety, and to observe and to take an active role in fulfilling all statutory health and safety regulations.
14. Attending regular meetings with the Supervisor and supervisory team.
15. Undertaking certain communal responsibilities, the nature of which will be discussed and agreed by the Supervisors, but which may need to be changed from time to time during the course of the project.



16. Exchanging relevant information, relevant to the project both internally and externally: with staff, students, senior management and peers.
17. Comply with relevant QMUL policies and regulations with due regard to financial matters, harassment, equal opportunities, public interest disclosure, health and safety, intellectual property and patenting, data protection, HR or any other rules, regulations or codes binding on the member of staff.
18. Monitor research findings with a view to commercial exploitation, and to inform the Head of School (or line manager, as appropriate) and Head of Innovation & Enterprise of any appropriate novel research outcomes.
19. Demonstrate a commitment to continuing professional development.

The duties of the post outlined above are not exhaustive, and the post-holder will be expected to be co-operative and flexible, undertaking such administrative and other duties as may from time to time be reasonably expected of a member of research grade staff in a university.

This job description sets out the duties of the post at the time it was drawn up. Such duties may vary from time to time without changing the general character of the duties or level of the responsibility entailed. Such variations are a common occurrence and cannot in themselves justify a reconsideration of the grading of the post.

Please note there are strict *eligibility requirements* which apply to all Marie Skłodowska Curie Early Stage Researchers.

At the time of the appointment:

Applicants must not have resided or carried out his/her main activity (work, studies, etc.) in Ireland for more than 12 months in the 3 years immediately before appointment under the project;

AND

Applicants shall also be in the first four years of their research careers at the time of appointment by the host organisation and have not been awarded a doctoral degree.

For more information on Marie Skłodowska-Curie Innovative Training Networks (ITNs), please see:

<http://ec.europa.eu/mariecurieactions>.



This table lists the essential and desirable requirements needed in order to perform the job effectively. Candidates will be shortlisted based on the extent to which they meet these requirements.

Qualifications	Bachelor degree in Physics, at least upper second or equivalent	E	A
	Master degree in Theoretical Physics	D	A
	Excellent command of the English language	E	A/I
Knowledge	Knowledge of quantum field theory	E	A/I
Skills and Experience	Knowledge of some of the following topics: General Relativity, String Theory, Particle Physics, Phenomenology	D	A/I
	Ability to interpret the scientific literature and incorporate into project	E	A/I
	Ability to organise and prioritise own work and organise research within the project timetable	E	A/I
	Ability to maintain accurate and up to date records	E	A/I
	Understanding of the research process	E	A/I
	Computer literacy (for instance Mathematica or Maple)	E	A/I
	Able to build professional relationships and undertake effective team working	E	A/I
	Good communication skills orally and in writing, able to explain complex ideas to experts and non-experts	E	A/I
	Excellent Analytical skills	E	A/I
	Flexible and co-operative	E	A/I
	Self-motivated and hardworking	E	A/I
	Enquiring, critical approach to work	E	A/I
	Willing to travel and go on secondments with some notice	E	A/I
	Willing to participate in outreach and outreach training activities	E	A/I

Essential/Desirable:

E = Essential: Requirements without which the job could not be done.

D = Desirable: Requirements that would enable the candidate to perform the job well.

How Assessed:

A = Application

I = Interview

OM = Other Means (e.g. presentation, test, etc.)