Department/School of Mathematical Sciences

Research Associate in Constrained Quantum Many-Body Systems

Job Ref: REQ250412

As part of the University's ongoing commitment to redeployment, please note that this vacancy may be withdrawn at any stage of the recruitment process if a suitable redeployee is identified.

Project Description

Loughborough University invites applications for a Postdoctoral Research Associate position in theoretical physics, for a duration of **three years**. The successful candidate will join the Department of Mathematical Sciences to work with Dr. Achilleas Lazarides on the research project "Constrained Quantum Systems", funded by the Leverhulme Trust.

The project aims to open new directions in many-body quantum dynamics by systematically constructing and analysing quantum systems with kinetic constraints — a promising, yet largely undeveloped, mechanism for ergodicity breaking and slow dynamics without disorder. Drawing inspiration from classical kinetically constrained models of glassy behaviour, we will develop quantum analogues that feature irreducible constrained dynamics, spatial asymmetry, and novel forms of dynamical arrest.

Key goals include identifying mechanisms for slow relaxation and non-ergodicity in translation-invariant quantum systems; classifying constrained dynamical universality classes; and developing analytical and numerical tools capable of probing highly non-trivial many-body dynamics.

The project will employ a range of techniques, including exact diagonalisation, Krylov subspace dynamics, random matrix-inspired methods, perturbative and variational approximations, and rigorous arguments. There is substantial scope for theoretical innovation in both model development and analytical/numerical approaches.

We are looking for candidates with a strong research background in theoretical quantum many-body physics, statistical mechanics, non-equilibrium dynamics, or closely related areas. Applicants should have expertise in analytical and/or numerical methods for interacting quantum systems. Familiarity with constrained dynamics, kinetic constraints, glassy systems, or random matrix techniques would be an advantage but is not required.

The successful candidate will have the opportunity to shape the development of a new research direction at the interface of quantum dynamics and non-equilibrium statistical mechanics.

Informal enquiries are encouraged and can be directed to Dr. Achilleas Lazarides (A.Lazarides@lboro.ac.uk).

Job Description

Job Grade: Specialist and Supporting Academic Grade 6

Job Purpose

To conduct research in the area of constrained many-body physics. To develop the numerical and analytical tools to understand the effect of spatial asymmetry, detailed balance and long-range interactions on one- and two-dimensional models. To develop models with healing phases and use those to construct exotic phases of matter. To develop new approaches to studying such models inspired by random matrix theory.

Job Duties

- To become familiar with the current state of the art in constrained quantum many-body systems
- To conduct research on novel classical and quantum constrained models
- To develop a new approach, inspired by random matrix theory, to this class of models
- To write research papers suitable for publication in high quality academic journals.
- To attend and contribute to conferences.
- To support the project leader by enhancing relationships with existing collaborators and by assisting the establishment of relationships with new collaborators
- Where appropriate, to deliver teaching and tutorial sessions to students.
- Engage in training programmes in the University (or elsewhere) that are consistent with the needs and aspirations of the project and those of the Department.
- Undertake other duties as may be reasonably requested and that are commensurate with the nature and grade of the post.

Points To Note

The purpose of this job description is to indicate the general level of duties and responsibility of the post. The detailed duties may vary from time to time without changing the general character or level of responsibility entailed.

Special Conditions

All staff have a statutory responsibility to take reasonable care of themselves, others and the environment and to prevent harm by their acts or omissions. All staff are therefore required to adhere to the University's Health, Safety and Environmental Policy & Procedures.

All staff should hold a duty and commitment to observing the University's Equity & Diversity policy and procedures at all times. Duties must be carried out in accordance with relevant Equity & Diversity legislation and University policies/procedures.

Successful completion of probation will be dependent on attendance at the University's mandatory courses which include Belonging and Inclusion and, where appropriate, Recruitment and Selection.

Organisational Responsibility

Reports to Dr. Achilleas Lazarides.

Person Specification

Your application will be reviewed against the essential and desirable criteria listed below. Applicants are strongly advised to explicitly state and evidence how they meet each of the essential (and desirable) criteria in their application. Stages of assessment are as follows:

1 – Application
2 – Test/Assessment Centre/Presentation
3 – Interview

Essential Criteria

Area	Criteria	Stage
Experience	Publication record at a level commensurate with career stage	1
	Research experience in theoretical physics	1,3
	Expertise in many-body quantum physics	1,3
	Experience of authoring original work for academic journal papers	1
	Experience delivering presentations at conferences and/or workshops.	1
Skills and abilities	Working knowledge of elementary numerical methods for quantum systems (at the level of exact diagonalisation)	1,3
	Practical programming skills	1,3
	Excellent written and oral communication skills	1,3
	Excellent interpersonal, and organisational skills	3
	Working knowledge of specific analytical, numerical methods [*specify*]	
Qualifications	PhD (or near completion)	1
Other	Commitment to observing the University's Equal Opportunities policy at all times.	3

Desirable Criteria

Area	Criteria	Stage
Experience	Prior experience in the area of constrained or disordered models	1,3
	Working knowledge of numerical approaches such as TEBD and similar	1,3
	Strong publication track record	1
	Developing proposals for funding from external agencies	1,3

	Teaching and/or supervision of students.	1
Skills and abilities	Authoring original work in the highest quality refereed academic journals	1

Conditions of Service

The position is full time and fixed term. Salary will be on Specialist and Supporting Academic Grade 6 (£35,116- £45,413 per annum), at a starting salary to be confirmed on offer of appointment.
The appointment will be subject to the University's Terms and Conditions of Employment for staff grades 6 and above, details of which can be found here.

The University is committed to enabling staff to maintain a healthy work-home balance and has a number of family-friendly policies which can be found here.

The University offers a wide range of employee benefits which can be found here.

We also offer an on-campus nursery with subsidised places, subsidised places at local holiday clubs and a childcare voucher scheme (further details are available at: http://www.lboro.ac.uk/services/hr/a-z/childcare-information---page.html

In addition, the University is supportive, wherever possible, of flexible working arrangements.
We also strive to create a culture that supports equality and celebrates diversity throughout the campus. The University holds a Bronze Athena SWAN award which recognises the importance of support for women at all stages of their academic career. For further information on Athena SWAN see http://www.lboro.ac.uk/services/hr/athena-swan/

Applications

The closing date for receipt of applications is **08/06/2025.** Interviews will be held as soon as possible thereafter.