The School of Mathematical Sciences of Queen Mary University of London invite applications for a PhD project commencing either in September 2019 for funded students, or at any point in the academic year for self-funded students.

This project supported by a Leverhulme Trust Research Project Grant for a proposal titled: ‘New investigations in automorphic forms: analytic and arithmetic interfaces’ and will be supervised by Dr Abhishek Saha. The deadline for funded applications is 31 January 2019.

The goal of this project is to better understand the properties of automorphic forms of higher rank, especially in situations involving high ramification. Automorphic forms are central objects in the Langlands program, a vast web of theorems and conjectures that connects concepts coming from number theory, representation theory and geometry. The simplest examples of automorphic forms include Dirichlet characters and classical modular forms, both of which have proved to be of profound importance in modern mathematics. More generally, automorphic forms are complex valued functions that can be naturally viewed as vectors inside representations known as automorphic representations. This viewpoint allows one to associate automorphic forms to any reductive algebraic group. From a different point of view, automorphic forms include (as special cases) eigenfunctions of Laplacians on arithmetic manifolds. This viewpoint allows one to bring in a whole range of additional perspectives coming from analysis, spectral theory and quantum mechanics. Automorphic forms and the L-functions attached to them have been key ingredients in the solutions of many famous and difficult problems, such as Wiles’ proof of Fermat’s last Theorem and Duke’s work on the representations of algebraic integers by ternary quadratic forms.

A central theme in modern number theory is to understand key properties of automorphic forms and their associated L-functions as one or more of their defining parameters vary. The finite or non-archimedean part of these parameters can be captured by a fundamental arithmetic quantity called the conductor or level (henceforth denoted by $N$) that measures its total ramification (or complexity at finite primes). The level appears in the functional equation of the attached L-function, as well as (essentially) describes the arithmetic manifold that the automorphic form lives on. Compared to the archimedean aspect, there has been relatively little progress in the level aspect versions of analytic problems about automorphic forms, especially in higher rank.

In this project, the student will investigate key questions related to the themes described above. The tools used will be a mix of algebraic as well as analytic number theory, together with representation theory of $p$-adic groups. The specific problems to be solved will depend on the interests of the student (possible examples include sup-norms and other $L^p$ norms, period formulas, etc.)
The application procedure is described on the School website. For further inquiries please contact Dr Abhishek Saha at Abhishek.Saha@qmul.ac.uk. This project has secured full funding from the Leverhulme Trust (for UK/EU applicants only), including support for 3.5 years’ study, funding to travel to conferences and research visits (at least £6000) and funding for relevant IT needs.

**Funding Notes**

This project can be also undertaken as a self-funded project, either through your own funds or through a body external to Queen Mary University of London. Self-funded applications are accepted year-round.

The School of Mathematical Sciences is committed to the equality of opportunities and to advancing women’s careers. As holders of a Bronze Athena SWAN award we offer family friendly benefits and support part-time study. Further information is available here. We strongly encourage applications from women as they are underrepresented within the School.

We particularly welcome applicants through the China Scholarship Council Scheme.