

Anticyclotomic Iwasawa Theory for Abelian Varieties with complex multiplication (and applications to telecommunications)

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PROJECT DESCRIPTION

Abelian varieties, which are the main objects of interest in this research project, play a central role in many parts of mathematics including its applied areas. For example, elliptic curves (one-dimensional abelian varieties) are used in algorithms to encrypt data for transmission, and for efficient digital signatures. In basic terms, an elliptic curve is a special kind of polynomial equation in two variables.

The main goal in this proposed research project is to prove results towards the validity of the Birch and Swinnerton-Dyer conjecture¹ ² (one of the seven Millennium Problems of the Clay Mathematics Institute) for abelian varieties with complex multiplication. In more precise terms, the student will investigate the behaviours of the Mordell–Weil and Selmer groups of a given abelian variety with complex multiplication, as one climbs up the anticyclotomic tower of a base CM field.

This project will rely on a blend of ideas from a variety of topics; ranging from arithmetic algebraic geometry to p -adic Hodge theory. In the duration of this project, the student will gain expertise in all these topics.

The proposed project lies in a very competitive research area, but as such, also has the potential of great impact. This project will also pursue potential applications of abelian varieties with complex multiplication in Telecommunications.

For further information, candidates are advised to contact Kazım Büyükboduk at the email address indicated below.

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¹<http://www.claymath.org/millennium-problems/birch-and-swinnerton-dyer-conjecture>

²<http://www.claymath.org/sites/default/files/birchswin.pdf>