ONLINE SEMINAR

ARITHMETIC ALGEBRAIC GEOMETRY

(organizers: Grzegorz Banaszak, Piotr Krasoń)

February 15, 2023, 06:00 PM Warsaw

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Fitting ideals of class groups, and a new notion of equivalence

Abstract: It is well known that analytic sources, like zeta and L-functions, provide information on class groups. Not only the order of a class group but also its module structure over a group ring has been studied in this way. An optimistic goal would be determining class groups up to module isomorphism, but this seems very difficult. A popular approximation consists in determining the Fitting ideal. The prototypical result (we omit all hypotheses and restrictions) exhibits the Fitting ideal of a class group as the product of a certain ideal J and a so called equivariant L-value ω in a group ring. The element ω generates a principal ideal, but its description is analytic and complicated. On the other hand, the ideal J is usually far from principal but has a much more elementary description. In this talk we intend to describe a few recent results of this kind, and we explain a new concept of "equivalence" of modules (joint work with Takenori Kataoka). This leads to a finer description of the class groups a priori than just determining its Fitting ideal; in other words, we look for a way of improving the above-mentioned approximation.