Recent Developments on the Arithmetic of Special Values of L-functions
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Stark-Heegner points are conjectural substitutes for Heegner points when the imaginary quadratic field of the theory of complex multiplication is replaced by a real quadratic field $K$. They are constructed analytically as local points on elliptic curves with multiplicative reduction at a prime $p$ that remains inert in $K$, but are conjectured to be rational over ring class fields of $K$ and to satisfy a Shimura reciprocity law describing the action of $G_K$ on them. This amounts to claiming that any linear combination of Stark-Heegner points weighted by the values of a ring class character of $K$ should belong to the corresponding piece of the Mordell-Weil group over the associated ring class field. In this lecture I will report on joint work with H. Darmon, where we show that such linear combinations arise from the localisation at primes above $p$ of global classes in the idoneous pro-$p$ Selmer group. The proof rests on a direct comparison between Stark-Heegner points and the generalised Kato classes arising from the Euler system of diagonal cycles.

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A converse theorem of Gross-Zagier and Kolyvagin: CM case

Let $E$ be a CM elliptic curve over rationals and $p$ an odd ordinary prime. Assume that $p$-Selmer group of $E$ has corank one, we show that the analytic rank of $E$ is also one. This is joint work with Ashay Burungale.