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Iwasawa Invariants of fine Selmer groups of congruent abelian varieties

Let $K$ be a number field and let $A_1$ and $A_2$ be abelian varieties defined over $K$. Assume that $A_1[p^l]$ and $A_2[p^l]$ are isomorphic as $G_K$-modules for some sufficient large $l$. Let $K_\infty$ be a strongly $\Sigma$-admissible $p$-adic Lie extension (for a suitable set of primes $\Sigma$). Generalizing work of Greenberg-Vatsal and Lim-Sujatha we prove an inequality between the $\mu$-invariants of the fine Selmer groups of $A_1$ and $A_2$ along the extension $K_\infty/K$. If $p^l$ annihilates the $p$-primary submodule of both Selmer groups we can even show that the $\mu$-invariants are equal and that the $p$-primary subgroups are pseudo-isomorphic to each other. If $K_\infty/K$ is a $\mathbb{Z}_p$-extension we can derive relations of the corresponding $\lambda$-invariants – without assuming that $\mu$ vanishes.

This is joint work with Sören Kleine.