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L-functions and algebraic K-theory

Arguably the most influential conjecture in K-theory in the previous century is Quillen-Lichtenbaum's, relating the ratio of even and odd K-groups to special values of the zeta function. This has since been resolved by Voevodsky and Rost, leading to striking development in motivic cohomology and homotopy theory. Dirichlet and Artin L-functions are generalizations of the zeta functions, where one keeps track of an additional character χ of the Galois group. One is then led to ask if these values admit similar K-theoretic interpretations. I will report on joint work with Ningchuan Zhang, where we formulate the twisted variants of the Quillen-Lichtenbaum conjectures, relating the size of K-groups with coefficients in an equivariant Moore spectrum $M(\chi)$ with special values of Artin L-functions, and prove it in some cases. I will focus on the case of finite fields where we obtain the equality:

$$Nm_{\mathbb{Q}[\chi]/\mathbb{Q}} L(-n,\chi) = \frac{\#\pi_{2n}^{C_m}\left(K(\mathbb{F}_{q^m})\otimes M(\chi)\right)}{\#\pi_{2n-1}^{C_m}\left(K(\mathbb{F}_{q^m})\otimes M(\chi)\right)} \qquad n \geq 1$$

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