KK-theory with $\mathbb{R}$-coefficients and discrete group actions on C^*-algebras

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Let Γ be the fundamental group of a closed manifold X and $\alpha\colon \Gamma \to U_n$ a finite dimensional unitary representation, i.e. a flat unitary vector bundle over X. To these data, Atiyah, Patodi and Singer associated a class $[\alpha]$ in the group $K^1(X, \mathbb{R}/\mathbb{Z})$ and investigated its relation to spectral rho invariants.

In this talk, we take an operator algebraic point of view on the class $[\alpha]$ and generalise it to the noncommutative setting of a discrete group Γ suitably acting on a C^*-algebra A.

The condition on the action is encoded by KK-theory with $\mathbb{R}$-coefficients, which will be introduced, and can be called K-theoretical free and properness. We exhibit natural classes of Γ-algebras satisfying this property.

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