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Twisting property (T) and the Baum–Connes morphism by a non-unitary representation

Let G be a locally compact group and ρ a non-unitary finite dimensional representation of G. We consider tensor products of rho by some unitary representations of G in order to define two Banach group algebras analogous to the group C^*-algebras, $C^*(G)$ and $C^*_r(G)$. We then define a twisting of property (T) in terms of such algebras and we use these property to show that, for most of the Lie groups having property (T), any finite dimensional irreducible non-unitary representation ρ of G is isolated among representations of the form $\rho \otimes \pi$, for π an unitary representation of G. We then calculate the K-theory of such group algebras for a large class of groups satisfying the Baum–Connes conjecture and we show that they behave in the same way as the C^*-algebras, $C^*(G)$ and $C^*_r(G)$, at the level of K-theory.