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Algebraic quantum kk-theory

Let $\mathcal{G}$ be an algebraic quantum group in the sense of Van Daele. We define a bivariant K-theory on the category of $\mathcal{G}$-module algebras. For each pair (A, B) of $\mathcal{G}$-module algebras we define a group $\mathrm{kk}^{\mathcal{G}}(A, B)$ and consider the category $\mathfrak{KK}^{\mathcal{G}}$ whose objects are the $\mathcal{G}$-module algebras and the morphisms from A to B are the elements of $\mathrm{kk}^{\mathcal{G}}(A, B)$.

Consider the functor $j^{\mathcal{G}} : \mathcal{G}\text{-Alg} \to \mathfrak{KK}^{\mathcal{G}}$ which at the level of objects is the identity and at the level of morphisms sends $f : A \to B$ to its class $[f]$ in $\mathrm{kk}^{\mathcal{G}}(A, B)$. The category $\mathfrak{KK}^{\mathcal{G}}$ is triangulated and $j^{\mathcal{G}}$ is an excisive, homotopy invariant and $\mathcal{G}$-stable functor. Moreover, it is the universal functor for these properties.

The Green-Julg Theorem in Kasparov KK-theory states that if G is a compact group and B is a G-C^*-algebra, then there exists an isomorphism

$$\mu : \mathrm{KK}^G(\mathbb{C}, B) \to \mathrm{KK}(\mathbb{C}, B \rtimes G).$$

The main theorem of this talk is a version of Green-Julg Theorem for $\mathfrak{KK}^{\mathcal{G}}$ when $\mathcal{G}$ is a semisimple Hopf algebra. Let A be an algebra and B a $\mathcal{G}$-module algebra then there exists an isomorphism

$$\psi : \mathrm{kk}^{\mathcal{G}}(A^\tau, B) \to \mathrm{kk}(A, B\#\mathcal{G})$$

where $B\#\mathcal{G}$ denotes the smash product. In particular, we obtain that $\mathrm{kk}^{\mathcal{G}}(\mathbb{C}, B) \simeq \mathrm{KH}(B\#\mathcal{G})$.