

## WEAK EXPECTATIONS OF DISCRETE QUANTUM GROUP ALGEBRAS AND CROSSED PRODUCTS

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*Abstract.* In this article we study analogues of the weak expectation property of discrete group  $C^*$ -algebras and their crossed products, in the *discrete quantum group* setting, i.e., *discrete quantum group*  $C^*$ -algebras and crossed products of  $C^*$ -algebras with *amenable discrete quantum groups*.

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### REFERENCES

- [1] E. BÉDOS, G. J. MURPHY, L. TUSET, *Amenability and co-amenability of algebraic quantum groups II*, J. Funct. Anal. 201 (2003), no. 2, 303–340.
- [2] A. BHATTACHARYA, D. FARENICK, *Crossed products of  $C^*$ -algebras with the weak expectation property*, New York J. Math. 19 (2013), 423–429.
- [3] M. BRANNAN, *Approximation properties for locally compact quantum groups*, Topological quantum groups, 185–232, Banach Center Publ., 111, Polish Acad. Sci. Inst. Math., Warsaw, 2017.
- [4] N. P. BROWN, N. OZAWA,  *$C^*$ -algebras and finite-dimensional approximations*, Graduate Studies in Mathematics, 88. American Mathematical Society, Providence, RI, 2008.
- [5] J. CRANN, M. NEUFANG, *Amenability and covariant injectivity of locally compact quantum groups*, Trans. Amer. Math. Soc., 368 (1), 495–513, 2016.
- [6] U. FRANZ, A. SKALSKI, P. M. SOLTAN, *Introduction to compact and discrete quantum groups*, Topological quantum groups, Banach center publications, Vol. 11, 2017.
- [7] E. KIRCHBERG, *On nonsemisplit extensions, tensor products and exactness of group  $C^*$ -algebras*, Invent. Math. 112 (1993), no. 3, 449–489.
- [8] C. LANCE, *On nuclear  $C^*$ -algebras*, J. Functional Analysis 12 (1973), 157–176.
- [9] N. OZAWA, *About the QWEP conjecture*, Internat. J. Math. 15 (2004), no. 5, 501–530.
- [10] P. PODLEŚ, S. L. WORONOWICZ, *Quantum deformation of Lorentz group*, Comm. Math. Phys. 130 (1990), no. 2, 381–431.
- [11] A. SKALSKI, J. ZACHARIAS, *Approximation Properties and entropy estimates for Crossed Products by actions of amenable discrete quantum groups*, J. London Math. Soc. 82 (2010), no. 2, 184–202.
- [12] R. TOMATSU, *Amenable discrete quantum groups*, J. Math. Soc. Japan 58 (2006), 949–964.
- [13] S. VAES, R. VERGNIoux, *The boundary of universal discrete quantum groups, exactness, factoriality*, Duke Math. J. 140 (1) 35–84, 2007.
- [14] S. L. WORONOWICZ, *Compact matrix pseudogroups*, Commun. Math. Phys. 111 (1987), 613–665.
- [15] S. L. WORONOWICZ, *Compact quantum groups*, Symétries quantiques (Les Houches, 1995), North-Holland, Amsterdam 1998, 845–884.
- [16] E. BÉDOS, L. TUSET, *Amenability and co-amenability for locally compact quantum groups*, Internat. J. Math. 14 (8), 865–884, 2003.
- [17] P. M. SOLTAN, A. VISELTER, *A note on amenability of locally compact quantum groups*, Canad. Math. Bull. 57 (2), 424–430, 2014.