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Poisson boundaries over locally compact quantum groups

We present versions of several classical results on harmonic functions and Poisson boundaries in the setting of locally compact quantum groups $\mathbb{G}$. In particular, the Choquet–Deny theorem holds for compact quantum groups, and the result of Kaimanovich–Vershik and Rosenblatt, characterizing group amenability in terms of harmonic functions, admits a non-commutative analogue in the separable case. We further show that the Poisson boundary of the natural Markov operator extension of the convolution action of a quantum probability measure μ on $L_\infty(\mathbb{G})$ to $\mathcal{B}(L_2(\mathbb{G}))$, as introduced and studied – for general completely bounded multipliers on $L_1(\mathbb{G})$ – in my collaboration with M. Junge and Z.-J. Ruan, can be identified precisely with the crossed product of the Poisson boundary of μ under the coaction of $\mathbb{G}$ induced by the coproduct. This yields an affirmative answer, for general locally compact quantum groups, to a problem raised by M. Izumi (2004) in the commutative situation, in which he settled the discrete case, and unifies earlier results of W. Jaworski, V. Runde and myself. The talk is based on recent joint work with M. Kalantar and Z.-J. Ruan.