Constructions in minimal dynamics and applications to the classification of $C^*$-algebras

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What abelian groups can arise as the $K$-theory of $C^*$-algebras arising from minimal dynamical systems? In joint work with Robin Deeley and Ian Putnam, we completely characterize the $K$-theory of the crossed product of a space $X$ with finitely generated $K$-theory by an action of the integers and show that crossed products by a minimal homeomorphisms exhaust the range of these possible $K$-theories. We also investigate the $K$-theory and the Elliott invariants of orbit-breaking algebras. We show that given arbitrary countable abelian groups $G_0$ and $G_1$ and any Choquet simplex $\Delta$ with finitely many extreme points, we can find a minimal orbit-breaking relation such that the associated $C^*$-algebra has $K$-theory given by this pair of groups and tracial state space affinely homeomorphic to $\Delta$. These results have important applications to the Elliott classification program for $C^*$-algebras. In particular, we make a step towards determining the range of the Elliott invariant of the $C^*$-algebras associated to étale equivalence relations.