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Principal Actions of Discrete Groups

I will discuss joint work with Klaus Schmidt which investigates principal algebraic actions of a discrete countable group Γ. These are defined using the principal ideal generated by an element f of the integral group ring $\mathbb{Z}[\Gamma]$. We are able give at least partial answers some important dynamical questions, such as ergodicity, expansiveness, and entropy, using machinery such as the Fuglede-Kadison determinants from von Neumann algebras. There are still many fascinating open problems.