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Entropy, homoclinic group, algebraic actions and von Neumann algebras

Homoclinic points describe the asymptotic behavior of group actions on spaces and play an important role in the general theory of dynamical systems. In 1999, Doug Lind and Klaus Schmidt established relations between homoclinic points and entropy properties for expansive algebraic actions of $\mathbb{Z}^d$. Their proof depends heavily on the commutative factorial Noetherian ring structure of the integral group ring of $\mathbb{Z}^d$.

In a joint work with Hanfeng Li, we extend their results to expansive algebraic actions of polycyclic-by-finite groups.

Applying our results to the field of von Neumann algebras, we get a positive answer to a question of Deninger about the Fuglede-Kadison determinant to the case group is amenable. We also prove that for an amenable group, an element in the integral group ring is a non-zero divisor if and only if the entropy of corresponding principal algebraic action is finite.