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Gelfand-Kirillov Dimension in some Crossed Products

Let k be a field, R a k -algebra and $A = R[\theta_1, \theta_2, \dots, \theta_n]$ a Poincaré-Birkhoff-Witt extension of R . If each θ_i acts locally finitely on R , then we show that $GKdim(A) = GKdim(R) + n$. From this we deduce some results concerning incomparability, prime length and Tauvel's height formula in the crossed product $R \star g$ where g is a finite-dimensional Lie algebra acting as derivations on R . Similar results are obtained for $R \star G$, where G is a free abelian group of finite rank. As a corollary of the results for G , Tauvel's height formula is established in $R \otimes_k P(\lambda)$ where $P(\lambda)$ is the quantum torus.