Homological Dimensions of Rigid Modules

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We obtain various characterizations of commutative Noetherian local rings \((R, m)\) in terms of homological dimensions of certain finitely generated modules. For example, we establish that \(R\) is Gorenstein if the Gorenstein injective dimension of the maximal ideal \(m\) of \(R\) is finite. Furthermore we prove that \(R\) must be regular if a single \(\text{Ext}_{R}^{n}(I, J)\) vanishes for some integrally closed \(m\)-primary ideals \(I, J\) of \(R\) and for some integer \(n > \dim(R)\). Along the way we observe that local rings that admit maximal Cohen-Macaulay Tor-rigid modules are Cohen-Macaulay.

This is a joint work with O. Celikbas, M. Gheibi and M. Zargar.