Representation-theoretic properties of balanced big Cohen–Macaulay modules

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The first Brauer-Thrall conjecture, proved by Roiter in 1968, asserts that every Artin algebra of bounded representation type is of finite representation type. The induction scheme used in Roiter's proof prompted Gabriel to introduce a powerful invariant, known as the Gabriel-Roiter measure. The Gabriel-Roiter measure has been used by Ringel to give an alternative proof of a famous result of Auslander and Ringel-Tachikawa, asserting that an Artin algebra Λ is of finite representation type if and only if every left Λ-module is fully decomposable, i.e., it is a direct sum of finitely generated modules. Auslander in 1976, proved that every Artin algebra of infinite representation type possesses an infinitely generated indecomposable module, and it turns out that this result can also be deduced using the Gabriel-Roiter measure. Moreover, Beligiannis and Chen have proved that a Gorenstein Artin algebra Λ is of finite Gorenstein representation type if and only if any left Gorenstein projective Λ-module is fully decomposable. In this series of lectures, which is based on a joint work with Shokrollah Salarian and Fahimeh Sadat Fotouhi, we will assign a numerical invariant, for any balanced big Cohen-Macaulay module, and examine when a given balanced big Cohen–Macaulay module is fully decomposable; when *every* balanced big Cohen–Macaulay module is so; analogues of the first Brauer-Thrall conjecture for modules and analogues result for Gorenstein projective modules over Cohen–Macaulay artin Algebras in the sense of Auslander and Reiten. Our main tool will be the Gabriel-Roiter measure.