

UNIVERSIDADE FEDERAL DE SÃO CARLOS
DEPARTAMENTO DE MATEMÁTICA

COLÓQUIOS DO DM-UFSCAR

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Falará sobre

Gaps in the number of generators of monomial Togliatti systems

A longstanding open problem in Algebraic Geometry is the classification of smooth projective varieties verifying at least one Laplace equation. In [MMO] the authors provided a systematic way of producing examples of such varieties by relating them with homogeneous artinian ideals which fails weak Lefschetz property (WLP), such ideals are called Togliatti systems. In [MM] the authors proved that the number of generators of a minimal monomial Togliatti system of forms of degree d in $n + 1$ variables lies in the interval $\left[2n + 1, \binom{n + d - 1}{n - 1}\right]$. In this talk, we will introduce the notion of Togliatti systems, their relation with varieties verifying at least one Laplace equation, and prove that the interval $[2n + 3, 3n - 1]$ can not be realized as the number of generators of a minimal monomial Togliatti system.

The existence of such gap for the number of generators of Togliatti systems, rises the following question: what happens when we consider only smooth minimal monomial Togliatti systems? Exploring the combinatorics associated with the toric varieties, we will prove that the gap $[2n + 3, 3n - 1]$ can be sharply improved to $[2n + 3, 3n]$ when considering the smooth case. As application of the existence of such gaps, we will show how the classification of Togliatti systems with number of generators lying in the border of existence can be achieved. Finally, we will discuss the existence of other gaps inside the admissible interval, and present some open problems.

References: [AAM] C. Almeida, A. V. Andrade, R. M. Miró-Roig, *Gaps in the number of generators of Togliatti systems*, Journal of Pure and Applied Algebra **223** (4) (2018), 1817–1831.
[MM] E. Mezzetti and R.M. Miró-Roig: *The minimal number of generators of a Togliatti system*, Annali di Matematica Pura ed Applicata **195** (2016), 2077-2098. DOI .10.1007/s10231-016-0554-y.
[MMO] E. Mezzetti, R.M. Miró-Roig and G. Ottaviani: *Laplace Equations and the Weak Lefschetz Property*, Canad. J. Math. **65** (2013), 634–654.

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