Université Lille Nord de France
Pôle de Recherche et d'Enseignement Supérieur

Ecole Graduée 631 MADIS

Sujet de thèse en Mathématique proposé en 2023

Titre : Smooth, definite fillings of 3-manifolds

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Descriptif : Many problems in low dimensional topology are related to the existence of certain smooth fillings of a given 3-manifold. In many cases the filling in question has homological constraints. It is of particular interest to understand smooth, definite fillings. In some cases classyfing smooth, definite fillings or detecting uniqueness can be achieved by via algebro-combinatorial techniques relying on Donaldsons' Diagonalization Theorem. This kind of results can lead to interesting consequences in various contexts such as : the structure of the knot concordance group, the study of rational and integral homology cobordism groups, the existence of embeddings of 3-manifolds in specific 4-manifolds, among other things.

The purpose of this thesis project is to push forward such investigations by exploring new applications. Early examples show that constraints on the existence of small definite fillings of certain plumbed 3-manifolds can be useful in understanding various classical geometrical problems such as : configurations of complex pseudo lines, configurations of singular rational plane curves, smoothings of rational surface singularities. These examples justify further investigations in these as well as similar problems from the point of view of smooth 4-manifold topology.

Références :

- R. Gompf, A. Stipsicz **4-manifolds and Kirby calculus**, Graduate Studies in Mathematics, AMS

- P. Aceto, D. Celoria, J. Park **Rational cobordisms and integral homology** Compositio Mathematica , Volume 156 , Issue 9 , September 2020 , pp. 1825 – 1845

- P. Aceto, D. McCoy, J. Park **Definite fillings of lens spaces** https://arxiv.org/abs/2208.02586