



XIAMEN UNIVERSITY MALAYSIA

廈門大學馬來西亞分校

Research Talk - Joint Seminar XMU & XMUM

CATEGORIFICATION: GEOMETRIC REPRESENTATION THEORY THROUGH A LINK INVARIANT

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Research interests: Geometric representation theory, homological algebra, symplectic topology, braid group, and many other topics.

SPEAKER INTRODUCTION

Dr. Nge Kie Seng is an Assistant Professor at the School of Mathematics and Physics in Xiamen University Malaysia. Dr. Nge Kie Seng graduated from Australian National University under the supervision of Anthony Licata in 2022.

ABSTRACT

Knot theory is an old subject in mathematics. In the recent years, it has gained much interest from the mathematicians again, partly due to its application in string theory. A long-standing problem in knot theory is the unknotting problem, to distinguish a knot from an unknot. This problem was solved by Haken's algorithm using a topological method. However, its implementation is almost impractical. In 1984, Vaughan Jones discovered a new link invariant called the Jones polynomial, bringing him the fame of being a Field medalist. The unknotting problem, in terms of a link invariant, now becomes if every knot having the same Jones polynomial as an unknot is necessarily an unknot. This is another unsolved problem.

In this talk, I will introduce a modern approach to the problem, that is categorification. Instead of solving the link problem (topology), we will turn the subject matter to braids (algebra) because Alexander's theorem says that every oriented link is a closure of a braid. Since the braids form a group, we construct a faithful categorical braid group action on a homotopy category of modules over a certain algebra. This method is proven success by Mikhail Khovanov, whereby Khovanov homology, categorifying Jones polynomial, does detect unknot (In fact, it did a better job than its classical counterpart.). But, not every faithful braid group representation will give a link invariant. In the future work, we will probe into the possibility of categorifying the Jones polynomial using a certain 2-categorical Fock space representation of Heisenberg algebra.