Links and Homotopy Groups

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Consider the following two questions:

(1) Let $L$ be a link consisting of $n$ rubber rings such that any nonempty sublink of $L$ is NOT splittable, namely that cannot be separated by a plane. **Question 1**: Determine the extra loops (extra rope) $l$ going around $L$ such that $l$ is linked with $L$ but $l$ becomes unlinked from $L$ if any one of the rubber rings is removed.

(2) Hold two separate trivial metal rings on a tree. Let $L$ be any $(n+2)$-link by adding $n$ link components rubber rings with each of them going around the both rings on the tree. **Question 2**: Determine the extra loops (extra rope) going around the link $L$ which would drop down to the ground by removing any one of the rubber rings.

In this talk, we will reformulate the above two questions into mathematical questions. Then we will give a surprising answer to these questions given in terms of homotopy groups. The talk aims to general audience and so we will explain relevant concepts such as link groups and homotopy groups.

**Speaker Biography**

Professor Jie Wu was born in Zhejiang, China in 1964. He obtained his master's degree in mathematics from Nankai University in 1989 and his PhD degree from the University of Rochester in 1995. After taking his postdoctoral/lectural positions in University of California in Berkeley, University of Toronto and University of Pennsylvania, he joined with National University of Singapore in 1999 with promotion to a full professor in 2009. His main research interests are algebraic topology with connections to braids, links, mapping class groups and representation theory. His joint work with Professor Paul Selick established a fundamental connection between unstable homotopy theory and the modular representation theory. His work on simplicial groups gave a combinatorial description of homotopy groups of spheres. Due to the surprising discovery on a fundamental connection between the theory of braids and homotopy groups, he and Professor Jon Berrick shared the National Science Award of Singapore in 2007. He published over 30 research papers in Journal of American Mathematical Society and other reputable journals. His new work joint with his coauthors gives a fundamental connection between link groups and homotopy groups.

**Host**: Division of Mathematical Sciences, School of Physical and Mathematical Sciences