

Minicourse: The Topology of Knots and Three-Manifolds

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Tuesdays, Thursdays 11:40–12:55, Physics 235

November 4 through December 4

Over the past decade or two, there has been an explosion of activity in the topology of three- and four-manifolds. Results such as the Poincaré conjecturetheorem have greatly expanded our understanding of classification questions in the subject. From a topological perspective, much recent excitement has centered on new tools such as Seiberg–Witten invariants and Heegaard Floer homology.

This minicourse aims to cover some basic topics in low-dimensional topology, providing background needed to understand recent developments in the field. A main objective will be to introduce knots, Heegaard splittings of three-manifolds, and Dehn surgery on knots, culminating in a proof of the Lickorish–Wallace theorem that all compact orientable three-manifolds are obtained from the three-sphere by Dehn surgery on some link. In this vein, we will also discuss Kirby calculus, which indicates when two links yield the same three-manifold by surgery. Time permitting, there may be some discussion of Heegaard Floer homology and its relation to low-dimensional topology.

The level of the course is somewhat flexible but I will try to keep prerequisites to a minimum. Some basic familiarity with algebraic topology may be helpful, but a willingness to work with a plethora of three-dimensional diagrams is probably more important.

