Topic and goal

From its beginnings in the work of Floer and Khovanov, the theory of homological invariants of knots and three-manifolds has grown to touch on many areas of mathematics, including low-dimensional topology, algebraic geometry, representation theory, and string theory. A key goal of the program was to bring experts from all of these areas together and to promote fruitful collaboration and discussion between them.

Structure of the program

Three major areas of research were represented in the program:

- Low dimensional topology and Floer homology for 3-manifolds,

- Quantum invariants and interactions with string theory,

- Khovanov homology and categorification.

As well as a cross-disciplinary winter school held at the start of the program, each of these areas held a week-long workshop.

Some highlights

We are proud that these workshops were the forum for the announcement of important new developments in each of these areas! While we cannot be exhaustive, we here give some highlights from each area.

In low-dimensional topology, many of the program attendees were pulled into thinking about the L-space conjecture which relates Floer homology, algebra, and geometry. Progress was made towards understanding this conjecture. Highlights in physics included Breakthrough Prize winner Cumrun Vafa (Harvard) lecturing on the structure of the WRT invariants, as well as exciting new developments in colored knot homologies, quiver algebras, and the LMOV conjecture. In the workshop in the final week of the program, we witnessed the unveiling of a proof of some long-conjectured properties of the HOMFLYPT homology of torus knots, as well as the originator of the field - Khovanov - explaining his categorification of the fraction $\frac{1}{2}$. We must also mention a very successful satellite conference on low-dimensional topology on the Isle of Skye.

The final lecture of the program was given by Rothschild Professor Cameron Gordon, who summed up the state of affairs for the L-space conjecture — one of the most exciting new developments in Floer homology for 3-manifolds.

Follow up events

The interaction between mathematics and physics was found so valuable by the attending mathematical physicists, that it has spawned a couple of follow-up events under physical auspices in 2018. These are a six-week long program at the Kavli Institute in San Diego and a week-long conference at the Aspen Center.