

This course will be designed for graduate students who want to find out more about how gauge theory has been applied in low-dimensional topology. The subject goes back to the 1980's, with the work of Simon Donaldson with his use of the Yang-Mills equations in studying smooth four-manifolds. The work of Andreas Floer came soon after, with his definition of "instanton homology" for three-manifolds.

Recently, instanton homology has been the subject of renewed interest, with close connections to other developments such as Khovanov homology for knots. It may also have applications in unexpected places, such as spatial graphs and graph coloring.

The course will begin at the beginning by introducing the anti-self-dual Yang-Mills equations and the rich geometry that accompanies them. There will be occasional homeworks. For students who need a letter grade, there will be a final paper.

I will add or update reading suggestions as we go on, but see the Library Reserves page for now.