MTH 835 - Fall 2017

SYLLABUS

Contact information
Cagatay Kutluhan
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Office: Math 117
Office hours: TR 3:30 - 4:30 pm, or by appointment

Lectures
Time: TR 9:30 - 10:50
Place: Math 122

Course description: The goal of this course is to introduce the audience to Andreas Floer's instanton homology. Floer homology is a very powerful tool and an exciting subject that influenced the development of many new ideas in low-dimensional topology. Instanton homology is one of the first instances of Floer homologies. I will start by covering some of the required background—such as bundles, connections, and representation varieties—then we will move on to the definition instanton Floer homology. Donaldson's book [2, Chapters 1–5] will be our main reference for the most part, but we will refer to some other books and articles, some of which are listed below, as needed.
Prerequisities: MTH 627 and MTH 628.
Grading: This will be an IBL (Inquiry Based Learning) style course. That means students will be expected to get actively involved in the learning process. In particular, starting in the second week of November, students will be asked to make presentations in class on some papers centered around instanton homology for knots and its applications.

References

1. Peter Braam and Simon Donaldson, *Floer's work on instanton homology, knots and surgery.* The Floer memorial volume, 195–256, Progr. Math., **133**, Birkhuser, Basel, 1995
2. Simon Donaldson, *Floer homology groups in Yang-Mills theory.* With the assistance of M. Furuta and D. Kotschick. Cambridge Tracts in Mathematics, **147**. Cambridge University Press, Cambridge, 2002. viii+236 pp.
3. Andreas Floer, *An instanton-invariant for 3-manifolds.* Comm. Math. Phys. **118** (1988), no. 2, 215–240.
4. Andreas Floer, *Instanton homology, surgery, and knots. Geometry of low-dimensional manifolds, 1 (Durham, 1989)*, 97-114, London Math. Soc. Lecture Note Ser., **150**, Cambridge Univ. Press, Cambridge, 1990.
5. Andreas Floer, *Instanton homology and Dehn surgery. The Floer memorial volume*, 77-97, Progr. Math., **133**, Birkhuser, Basel, 1995.
6. Peter Kronheimer and Tomasz Mrowka, *Knots, sutures, and excision*, J. Differential Geom. 84 (2010), **no. 2**, 301-364.