

## **Vorlesungsangebot HU, October-December**

Aimed on advanced undergraduate students and graduate students.

**Field:** Geometry, topology and visualisation

**Title:** Invariants of Braids and Mapping classes, and Applications

(Course language may be English or German depending on the listeners)

**Lecturer:** Burglind Jöricke

**Type** Lecture(2h)

**Time and room:** Wednesday 9-11, first lecture 15.10., Rudower Chaussee 25, 2.009

### **Subject overview**

- Elementary introduction to braids and mapping classes.
- Introduction to Teichmüller Theory, including Thurston's theory of surface homeomorphisms and his classification of mapping classes.
- Elements of topological dynamics. Entropy of mapping classes.
- The Thirteen's Hilbert Problem.
- Two braid invariants (entropy and conformal module).
- Applications of the invariants. Relations to the 13th Hilbert Problem, symplectic geometry and to topological dynamics. The relation between the invariants.

**Comments.** Thurston's theory of surface homeomorphisms, in particular his classification of mapping classes, was motivated by his Geometrization Conjecture and plays a role in various topics of mathematics and physics. In particular, the entropy of mapping classes which was studied using Thurston's theory became a highly popular invariant used in pure and applied mathematics and physics.

There is a fascinating and somewhat surprising relation to the line of research in algebraic geometry related to the Thirteen's Hilbert Problem. The related braid invariant is the conformal module. Though the invariants come from different topics, entropy is an invariant of topological dynamics and the conformal module is a conformal invariant, there is a simple relation between them: they are inverse proportional.

There are applications to algebraic and symplectic geometry and other topics.

Though the material leads to contemporary research the explanation will be kept suitable for general audience and adapted to the listeners.

Literature:

- L.Ahlfors, Lectures on quasiconformal mappings, Van Nostrand, Princeton (1966).
- V.Arnol'd, On some Topological Invariants of Algebraic Functions, *Trudy Moskov. Mat. Obsc.* **21** (1970), 27–46. Engl. Transl.: *Trans. Moscow Math. Soc.* **21** (1970), 30–52.
- B.Farb, D.Margalit, Dan, A primer on mapping class groups. Princeton Mathematical Series,**49**. Princeton University Press, Princeton, NJ, (2012).
- A.Fathi, F.Laudenbach, V.Poénaru, Travaux de Thurston sur les surfaces. *Soc. Math. France, Paris*, 1979, *Astérisque* **66–67** (1991).
- C.Kassel, V.Turaev, Braid Groups, *Graduate Texts in Mathematics* **247**, Springer (2008).
- V.Lin, Algebraic functions, configuration spaces, Teichmüller spaces, and new holomorphic combinatorial invariants, *Funct.Anal.Appl.* **45** 3 (2011), 55-78.
- V.Lin, Around the 13th Hilbert Problem for algebraic functions, Proc. of the Hirzebruch 65 Conf. in Algebraic Geometry (Ramat Gan, 1993), Israel Math Conference Proc. **9**, Bar-Ilan Univ., Ramat Gan (1996), 307-327.

There will also be a detailed preprint.