

Principal Lectures

New Obstructions to Embedding 2–spheres in S^4

PETER TEICHNER

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The principal speaker for the Twenty-First Annual Workshop in Geometric Topology was Professor Peter Teichner of the University of California, Berkeley. His three-lecture series on “New Obstructions for Embedding 2–spheres in S^4 ” was the centerpiece of the workshop. The official abstract for these lectures was the following:

ABSTRACT. In joint work with Rob Schneiderman, we have developed a new obstruction theory for the embedding problem for 2-spheres in 4-manifolds. It is given in terms of the intersection theory of Whitney towers, immersed in the 4-manifold, and it is related to Milnor invariants and the Kontsevich integral in the easiest cases (where the 4-manifold is given by attaching 2-handles to a link in the 3-sphere). As a consequence, we give an intersection theoretic explanation of the Milnor invariants, and we relate them to the existence of embedded gropes in the 4-ball.

In this sequence of talks, we shall give an outline of the theory, explain the main results, and discuss the remaining open problems. There are 3 papers, all joint with Rob Schneiderman (and one also joint with Jim Conant) available on my homepage.

At the time these lectures were given, all of the main results had already been written up and were made available to workshop participants—primarily in preprint form. For this reason, the traditional writeup of the main lectures is not included in these proceedings. Instead, we provide full bibliographic information and electronic links for the corresponding papers. In addition, we have posted on the workshop website, scanned copies of the over-head slides used in each of the three lectures.

Papers

Rob Schneiderman and Peter Teichner, *Higher order intersection numbers of 2-spheres in 4-manifolds*, Algebraic & Geometric Topology, 1 (2001), 1-29.
(www.maths.warwick.ac.uk/agt/AGTVol1/agt-1-1.abs.html).

Rob Schneiderman and Peter Teichner, *Whitney towers and the Kontsevich integral*, Proceedings of a Conference in Honor of Andrew Casson, UT Austin 2003., Geo. & Top. Monogr. 7 (2004), 101-134.

(www.maths.warwick.ac.uk/gt/GTMon7/paper4.abs.html).

James Conant, Rob Schneiderman and Peter Teichner, *Jacobi identities in low-dimensional topology*, to appear in Compositio Mathematica.

(xxx.lanl.gov/abs/math.GT/0401427).

Slides from the Lectures

Lecture 1. *Intersection Theory for Whitney Towers:*

www.uwm.edu/Dept/Math/conf/topology/Lecture1.pdf

Lecture 2. *Whitney Towers and Milnor invariants:*

www.uwm.edu/Dept/Math/conf/topology/Lecture2.pdf

Lecture 3. *Gropes in 3- and 4-space:*

www.uwm.edu/Dept/Math/conf/topology/Lecture3.pdf