Title: *The Framed Graph Theorem and Applications*

May 16 (Thu.) 15:00 - 16:00, 16:20 - 17:20

The *framed graph theorem* is the key to understanding the low dimensional applications of the theory of higher FR-torsion, parametrized Morse theory and algebraic K-theory. The theorem says that every graph has a "framed structure" which is unique up to contractible choice. When the graph is a *fat graph*, i.e., having a cyclic ordering on the edges incident to each vertex, there is a canonical punctured surface given by "thickening" the graph and the framed structure determines a Morse function (in fact a *framed function*) on this surface.

In this lecture I will give a precise statement of the framed graph theorem, including the definition of the category of framed graphs and explain how it fits into the whole story.

Using the Morse function corresponding to a framed fat graph we can interpret certain cohomology classes in the mapping class group and the Torelli group. For example, there is an algebraic K-theory class in the second $\mathbb{Z}/2$-cohomology of the Torelli group $H^2(T_g^s;\mathbb{Z}/2)$. The framed graph theorem also gives a combinatorial description of the Miller-Morita-Mumford classes $\kappa_k \in H^{4k}(M_g^s;\mathbb{Z})$. This is very complicated, however I recently found a simplified version which is proportional to $(k-2)\kappa_k$. (So the simplified formula is zero in degree 4.)