

MINI COURSE: SYMPLECTIC FILLINGS AND MORE

Date : 7/26 (Tue.) – 7/28 (Thu.) 2016

Venue : Rm 440

NCTS (Astro-Math Bldg., NTU)

Organizers : River Chiang (NCKU)

Chung-I Ho (NTHU)

AIM & SCOPE

The mini course aims to introduce techniques and recent developments in low dimensional topology, with an emphasis on connections to symplectic geometry. The mini course is open to anyone.

SPEAKERS

Jongil Park (Seoul National University)

Cheuk Yu Mak (University of Minnesota)

CONTACT

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A G E N D A

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7/26 TUESDAY

10:00 - 10:30 Registration

10:30 - 12:00 Lecture 1 (Jongil Park)

13:30 - 15:00 Lecture 2 (Jongil Park)

7/27 WEDNESDAY

10:30 - 12:00 Lecture 3 (Jongil Park)

13:30 - 15:00 Lecture 4 (Jongil Park)

15:30 - 16:20 Talk 1 (Cheuk Yu Mak)

7/28 THURSDAY

10:30 - 12:00 Lecture 5 (Jongil Park)

13:30 - 14:20 Talk 2 (Cheuk Yu Mak)

MINI COURSE

Lecture Series by Jongil Park (Seoul National University)

▶ **Title : Symplectic fillings and Milnor fibers of quotient surface singularities**

▶ **Abstract :**

One of the active research areas in 4-manifold theory is to classify symplectic fillings of certain 3-manifolds equipped with a natural contact structure. Among them, people have long studied symplectic fillings of the link of a normal complex surface singularity. Note that the link of a normal complex surface singularity carries a canonical contact structure which is also known as the Milnor fillable contact structure.

For example, P. Lisca classified symplectic fillings of cyclic quotient singularities whose corresponding link is a lens space, and A. Nemethi and P. Popescu-Pampu identified the correspondence between the symplectic fillings in Lisca's classification and the Milnor fibers for cyclic quotient singularities. Furthermore, M. Bhupal and K. Ono tried to extend these results, so that they classified all possible symplectic fillings of quotient surface singularities.

In this series of lectures, I'd like to review basics on symplectic fillings and Milnor fibers of quotient surface singularities. Then I will explain some recent joint work (with Heesang Park, Dongsoo Shin, and Giancarlo Urzua) on identifying symplectic fillings with Milnor fibers of quotient surface singularities. Furthermore, if time allows, I'll also explain how we interpret symplectic fillings of quotient surface singularities as Lefschetz fibrations.

▶ **A tentative schedule is the following :**

Lec.1 : Backgrounds on singularities, symplectic fillings and Milnor fibers

Lec.2 : A review of known results on symplectic fillings of quotient surface singularities

Lec.3 : A resolution of singularities and Milnor fibers

Lec.4 : Identifying symplectic fillings with Milnor fibers

Lec.5 : A Lefschetz fibration viewpoint on symplectic fillings of quotient surface singularities

MINI COURSE

Two talks by Cheuk Yu Mak (University of Minnesota)

▶ **Title : Symplectic caps and application to symplectic fillings**

▶ **Abstract :**

We illustrate how a nice symplectic cap captures properties of symplectic fillings of a contact 3-manifold. Three kinds of symplectic caps are introduced. Divisorial caps are motivated from compactifying divisors in algebraic geometry. Uniruled caps give strong restriction to symplectic fillings for a class of contact 3-manifolds strictly larger than the planar ones. Calabi-Yau caps, in particular, can be used to derive uniform Betti numbers bounds on Stein fillings of the standard unit cotangent bundle of any hyperbolic surface. This is a joint work with Tian-Jun Li and Kouichi Yasui.

▶ **Title : Symplectic log Calabi-Yau surfaces**

▶ **Abstract :**

Recently, some mirror symmetric phenomena are observed for log Calabi-Yau surfaces. It is hence natural to ask for a classification of log Calabi-Yau surfaces from the symplectic perspective. In a joint work with Tian-Jun Li, we show that symplectic log Calabi-Yau surfaces are uniquely determined by the homological data of the boundary divisor up to symplectic deformation equivalence.