# **Geometry/ Topology Working Days FALL 2016**

The following introductory lecture series are organized for graduate students who are in their early studies. Registration is not needed for these days. For more information contact sonaran (at) hacettepe (dot) edu (dot) tr OR ferihe(dot)atalan (at) atilim (dot) edu (dot) tr

The talks of Day IV and Day V will be in Atılım University and Day VI will be in METU in Fall 2016. Each day there will be two speakers talking on the Theme of the Day and each day ends with a research talk on Geometry or Topology.

### Geometry/ Topology Working Day VI December 5th, 2016 METU

Schedule
9:30-10:15 Çağrı Karakurt, Boğaziçi University
"Introduction to Heegaard Floer Homology" Part I
10:15-10:30 Coffee/ Tea Break
10:30-11:30 Çağrı Karakurt, Boğaziçi University
"Introduction to Heegaard Floer Homology" Part II
11:30-13:00 Lunch Break
13:00-13:45 Sergey Finashin, METU
"Fundamentals of Modern 4-dimensional Topology" Part I
13:45-14:00 Coffee/ Tea Break
14:00-15:00 Sergey Finashin, METU
"Fundamentals of Modern 4-dimensional Topology" Part II
15:00-15:30 Coffee/ Tea Break
15:30-16:30 Ayşe Borat, Bursa Technical University
"Higher Dimensional Motion Planners for Configuration
Spaces"

DAY VI



Speakers of Day VI



Some participants of Day VI

Geometry/ Topology Working Day IV Symplectic Geometry September 23rd, 2016 Atılım University

Schedule

9:30-10:15 Yıldıray Ozan, METU
"An Introduction to Symplectic Geometry and Topology" Part I
10:15-10:30 Coffee/ Tea Break
10:30-11:30 Yıldıray Ozan, METU
"An Introduction to Symplectic Geometry and Topology" Part II
11:30-13:00 Lunch Break
13:00-13:45 Mohan Bhupal, METU-Cancelled
Sinem Onaran, Hacettepe University
"Techniques to built 4-manifolds, Symplectic 4-manifolds" Part I
13:45-14:00 Coffee/ Tea Break
14:00-15:00 Mohan Bhupal, METU-Cancelled
Sinem Onaran, Hacettepe University
"Techniques to built 4-manifolds, Symplectic 4-manifolds" Part II
15:00-15:30 Coffee/ Tea Break
15:30-16:30 Mehmet Akif Erdal, Bilkent University – Research
Talk
"Burnside rings of monoids"

### DAY IV – ABSTRACTS

### Speaker: Yıldıray Ozan, METU

Title: An Introduction to Symplectic Geometry and Topology

Abstract: First we will give a quick review of symplectic linear algebra. Then we will define symplectic manifolds, symplectic and Lagrangian submanifolds and give basic examples. After defining symplectomorphisms we will talk about Darboux and Weinstein Theorems and the Moser trick, the basic tool used in proving these theorems. Next we will talk about compatible almost complex structures on symplectic manifolds and the relations between symplectic, complex and Kahler geometries. Finally, we will introduce symplectic and Hamiltonian fows, symplectic reduction and talk about Arnold Conjecture if time permits.

### Speaker: Sinem Onaran, Hacettepe University

Title: Techniques to built 4-manifolds, Symplectic 4-manifolds

Abstract: In this talk we will define and study some techniques to built 4-manifolds such as Generalized Log transforms, Luttinger surgery, Normal sums, a special type of normal sum called Knot Surgery.

### Speaker: Mehmet Akif Erdal, Bilkent University

Title: Burnside rings of monoids

Abstract: Let M be a monoid. By an M-set we understand a set with a two sided action of M on it, and by an M-equivariant function we understand a function that is equivariant simultaneously on both sides. An M-set is called reversible if M acts by bijections from both sides. There is a subclass of the class of M-sets that forms a category together with M-equivariant functions, which we call category of M actions. This category carries a non-trivial homotopical structure, determined by the maximal reversible parts of the M-sets. We prove that this homotopical structure, restricted to the full-subcategory of left M-actions on finite sets, is 'saturated'; that is, weak equivalences in the category of finite M-sets are completely determined by isomorphisms in its homotopy category. By using this property we introduce the Burnside ring of a monoid and construct the Burnside mark homomorphism. By this way, we get the theory of Burnside rings for the monoids. We show that for a group this construction of Burnside ring coincides with the usual one, and for a commutative monoid it is equal to Burnside ring of its Gröthendieck group. This is a joint work with Özgün Ünlü.



Speakers of Day IV



Some participants of Day IV

## Geometry/ Topology Working Day V Contact Topology October 31st, 2016 Atılım University

Schedule
9:30-10:15 Sinem Onaran, Hacettepe University
"Contact Structures, Legendrian Knots, Contact Surgery" Part I
10:15-10:30 Coffee/ Tea Break
10:30-11:30 Sinem Onaran, Hacettepe University
"Contact Structures, Legendrian Knots, Contact Surgery" Part II
11:30-13:00 Lunch Break
13:00-13:45 Firat Arikan, METU-Cancelled
Sinem Onaran, Hacettepe University
"Contact Structures, Legendrian Knots, Contact Surgery" Part III
13:45-14:00 Coffee/ Tea Break
14:00-15:00 Firat Arikan, METU-Cancelled
Merve Seçgin, METU – Research Talk
"Classification of Surface Bundles over Circles"
15:00-15:30 Coffee/ Tea Break
15:30-16:30 Mehmetcik Pamuk, METU – Research Talk
"Surgery Teoretic Classification of Manifolds"

### DAY V - ABSTRACTS

### Speaker: Sinem Onaran, Hacettepe University

### Title: Contact Structures, Legendrian Knots, Contact Surgery

Abstract: In this talk, we will define contact structures on 3-manifolds and Legendrain knots in contact 3manifolds and study the classical invariants of Legendrian knots. Then we will review Dehn surgery for topological manifold and study its contact analogue: contact surgery.

### Speaker: Merve Seçgin, METU

Title: Classification of Surface Bundles over Circles

Abstract: In this talk, we will first introduce some geometric structures on prime oriented closed 3-manifolds. Next, we will mention about Nielsen-Thurston Classification that classify homeomorphisms of a compact orientable surface. We will then give the definiton of surface bundle over circle and relation between geometric structures on it and the Nielsen-Thurston Classification. Finally we will constract infinitely many hyperbolic 3-manifolds by using the relation. This is a joint work with Fırat Arıkan.

### Speaker: Mehmetcik Pamuk, METU

Title: Surgery Teoretic Classification of Manifolds

Abstract: The aim of this talk will be to give a down-to-earth presentation of the classification of manifolds in dimension greater than or equal to five. Our primary tool for classification will be surgery theory.



Speakers of Day V



Some participants of Day V

# **Geometry/ Topology Working Days SPRING 2016**

## Geometry/ Topology Working Day I Mapping Class Groups March 18th, 2016

Hacettepe University

Schedule

9:00-10:30 Ferihe Atalan, Atılım University
"Mapping class groups and complexes of curves"
10:30-11:00 Coffee/ Tea Break
11:00-12:30 Adalet Çengel, METU
"Mapping class groups and Lefschetz fibrations"
12:30-13:30 Lunch Break
13:30-15:00 Ingrid Irmer, METU
"Stable commutator lenghts in low dimentional topology"
15:00-15:30 Coffee/ Tea Break
15:30-17:00 Ahmet Beyaz, METU
"Surfaces in 4-manifolds"

## Geometry/ Topology Working Day II Contact Topology April 15th, 2016

Hacettepe University

Schedule
9:00-10:30 Elif Medetoğulları, Atılım University
"Introduction to Contact Topology and Convex Surfaces"
10:30-11:00 Coffee/ Tea Break
11:00-12:30 Fırat Arıkan, METU
"Dehn surgery, Legendrian knots, contact surgery and Kirby
diagrams"
12:30-13:30 Lunch Break
13:30-15:00 Elif Dalyan, Hitit University
"Open book decompositions and contact structures"
15:00-15:30 Coffee/ Tea Break
15:30-17:00 Serap Gürer, Galatasaray University
"(Co)homology Theories on diffeological spaces"

### Geometry/ Topology Working Day III Algebraic Geometry May 13th, 2016 METU

Schedule 9:00-10:30 Selma Altınok Bhupal, Hacettepe University

"Introduction to Algebraic Geometry"
10:30-11:00 Coffee/ Tea Break
11:00-12:30 Özgür Kişisel, METU
"Tropical Algebraic Geometry"
12:30-13:30 Lunch Break
13:30-15:00 Tolga Karayayla, METU
"Elliptic surfaces and some related problems"
15:00-15:30 Coffee/ Tea Break
15:30-17:00 Gökhan Elmas, GATECH
"Open Book Decompositions in Higher Dimensional Contact
Manifolds"

### **DAY I – ABSTRACTS**

#### Speaker: Ferihe Atalan, Atılım University

Title: Mapping class groups and complexes of curves

Abstract: In this talk, I will first give the definitions of some basic concepts such as curves on a surface, the mapping class group and Y-homeomorphisms. Second, I will mention about the complex of curves of a surface S. The mapping class group of S acts on this complex in a natural way. N. V. Ivanov proved the first result on the automorphism group of the curve complex. Several other complexes are defined similarly including the complex of separating curves, the complex of nonseparating curves, the pants complex and the Hatcher-Thurston complex. The automorphism groups of these complexes are all isomorphic to the mapping class group of S. I will give an outline of the proof the fact that the automorphism group of the curve complex of a nonorientable surface N is isomorphic to the mapping class group of the surface N joint with Mustafa Korkmaz.

#### Speaker: Adalet Çengel, METU

Title: Mapping class groups and Lefschetz fibrations

Abstract: The theory of mapping class groups has important connections with several branches of low dimensional topology. In this talk, I will first recall definition and some properties of mapping class groups and then focus on relations among them. Later I will explain how mapping class groups relate to Lefschetz fibrations on 4-manifolds. I will finish by giving some results about Lefschetz fibrations over S^2 thanks to mapping class groups.

### Speaker: Ingrid Irmer, METU

Title: Stable commutator lenghts in low dimentional topology

Abstract: Commutator length is a group theoretical analogue of genus. It can be stabilised to give stable commutator length; a group invariant that can be studied topologically. There are many open questions regarding computability of stable commutator lengths. This talk will give some estimates for stable commutator lengths for groups arising in low dimensional topology, and some background on algorithms using simple branched surfaces. If there is time, a closely related norm- the Thurston norm- defined on 3-manifolds will be introduced.

#### Speaker: Ahmet Beyaz, METU

Title: Surfaces in 4-manifolds

Abstract: Surfaces in a four dimensional manifold carry information about the topological, smooth or complex structures on it. This talk is an overview of their use. The talk is aimed as an introduction to four dimensional topology. It will review the approaches to classification problems therein.



Speakers of Day I



Some participants of Day I

### DAY II – ABSTRACTS

### Speaker: Elif Medetoğulları, Atılım University

Title: Introduction to Contact Topology and Convex Surfaces

Abstract: Convex surface theory is one of the first tools that is used in the classification problem of tight contact structures and Legendrian knots. This talk will be about the classification problem of tight contact 3-manifolds and some fundamental notions of convex surfaces such as dividing curves, bypasses, edge rounding and imbalance principle. As an application, number of tight contact structures on some contact 3-manifolds will be computed.

### Speaker: Fırat Arıkan, METU

Title: Dehn surgery, Legendrian knots, contact surgery and Kirby diagrams Abstract: We first describe the surgery operation in different categories and explain its relation with handle attachments and cobordisms. Then, as an illustration of surgery technique, we will give an "almost" complete proof of the "Martinet's Theorem" stating "Every closed orientable three-manifold admits a contact structure". In addition to some results obtained by surgery operation, several examples involving (contact) surgery diagrams of three manifolds and handle decompositions of corresponding four manifolds will be given.

### Speaker: Elif Dalyan, Hitit University

### Title: Open Book Decompositions and Contact Structures

Abstract: We will talk about open book decompositions of an n-manifold, give several examples. Then in dimension three explain an open book supporting a contact structure. There is a well known relation between these, we will state and try to see these relations. From these relations, we can define invariants and we will talk about my results related with these.

### Speaker: Serap Gürer, Galatasaray Üniversitesi

Title: (Co)homology Theories on diffeological spaces

Abstract: Diffeology gives a way to extend notions of differential topology beyond manifolds and the category of diffeological spaces is well-behaved. In this talk, I will give an overview of this new field, together with its viewpoint towards algebraic topology. I will give some results about (co)homology theories on diffeological spaces category.



Speakers of Day II



Some participants of Day II

# DAY III



Speakers of Day III



Some participants of Day III