18.727 TOPICS IN ALGEBRAIC GEOMETRY: POSITIVITY IN ALGEBRAIC GEOMETRY

İzzet Coşkun, M 4-5:30, W 4:15-5:45
2-167, coskun@math.mit.edu

Welcome to 18.727! The purpose of this course is to partially bridge the gap between introductory courses in algebraic geometry and current research in higher dimensional complex algebraic geometry. We will develop the theory of big and nef line bundles, vanishing theorems and multiplier ideals in order to understand the geometry of higher dimensional varieties. The focus of the course will be on concrete examples and applications. We will end the course by discussing current developments such as Siu's Theorem on the invariance of plurigenera, Boucksom, Demailly, Paun and Peternell's characterization of uniruled varieties and some recent progress in the Minimal Model Program. The course will follow Rob Lazarsfeld's Positivity in Algebraic Geometry Vol I and II.

Course webpage: http://www-math.mit.edu/~coskun/nmath18727.html

Text: Robert Lazarsfeld, Positivity in Algebraic Geometry I and II, Springer 2004.

Office hours: W 2:30-3:30 at 2-167

Prerequisites: An introductory course in complex or algebraic geometry at the level of Hartshorne's Algebraic Geometry or Griffiths and Harris' Principles of Algebraic Geometry.

Requirements: Those who need a grade in the course need to turn in a 10-12 page final paper at the end of the semester.

Topics: The following is a tentative list of topics that may be covered in the course:

Sep 6	Ample line bundles: Definitions and examples
Sep 11	The Nakai-Moishezon criterion and properties of ample line bundles
Sep 13	NEF Cones and Kleiman's criterion
Sep 18	Castelnuovo-Mumford regularity
Sep 20	Big line bundles
Sep 25	Examples and Zariski decomposition
Sep 27	Lefschetz Theorems I
Oct 2	No class, Yom Kippur
Oct 4	Lefschetz Theorems II
Oct 9	Connectedness theorems
Oct 11	No class (I am away)
Oct 16	Applications

Oct 18	Kodaira-Nakano and Kawamata-Viehweg vanishing theorems
Oct 23	Local positivity and Seshadri constants
Oct 25	Applications
Oct 30	Multiplier ideals I: Definitions
Nov 1	Multiplier ideals II: Basic examples
Nov 6	Nadel vanishing
Nov 8	Non-vanishing and global generation of multiplier ideals
Nov 13	Other properties of multiplier ideals
Nov 15	Skoda's Theorem
Nov 20	Singularities and Matsusaka's Theorem
Nov 22	Thanksgiving (The Anghern-Siu Theorem and the Nullstellensatz)
Nov 27	Asymptotic multiplier ideals: Definitions and examples
Nov 29	Properties of asymptotic multiplier ideals
Dec 4	Fujita approximations
Dec 6	The duality of $\overline{\text{Mov}}$ and $\overline{\text{Eff}}$ and uniruled varieties
Dec 11	The invariance of plurigenera
Dec 13	A few words about the MMP