COURSE ANNOUNCEMENT

MODEL-THEORETIC STABILITY AND BEYOND

MATH 223M, SPRING 2022

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Description. Model theory is a branch of mathematical logic that studies definability in families of mathematical structures in a fixed formal language. For example, in the case of an algebraically closed field definable sets correspond to the constructible ones, and in the case of a real closed field to the semialgebraic ones. Since the early days of the subject, it was closely connected to set theory and foundational questions in mathematics, in particular to infinitary combinatorics — the study of the properties of various infinite objects such as linear orders and trees in relation to cardinal arithmetic. Later on, with the development of *stability theory* by Shelah, Zilber, Hrushovski, Pillay and others, the subject has gained a strong geometric feel and content, and found multiple applications in some of the more traditional branches of mathematics such as algebra, number theory and combinatorics.

The aim of this course is to give an introduction to stability theory and some of its generalizations (NIP, simplicity, NTP_2, ...) and to survey some applications and connections to other subjects such as set theory, algebra and combinatorics.

Syllabus. Boolean algebras of definable sets and spaces of types, type-definable sets, saturation and monster models, automorphism group, imaginaries and M^{eq}, Shelah's classification, stability, indiscernible sequences, definability of types, NIP, ideals in Boolean algebras, forking and independence, ranks, stable groups, connected components and generics, group reconstruction theorems.

Prerequisites. Basic first-order logic and model theory (Math 220A), basic general topology and abstract algebra (please contact me if in doubt about your prerequisites).

Course text. I will follow my own notes. Possible references for parts of the material:

- Chernikov, Artem. Lecture Notes on Stability theory (https://www.ams.org/open-math-notes/omn-view-listing?listingId=110792)
- Pillay, Anand. Geometric stability theory. No. 32. Oxford University Press, 1996.
- Marker, David. Model theory: an introduction. Springer Science & Business Media, 2002.
- Tent, Katrin, and Martin Ziegler. A course in model theory. Vol. 40. Cambridge University Press, 2012.

- Simon, Pierre. A guide to NIP theories. Vol. 44. Cambridge University Press, 2015.
- Bays, Martin. Geometric Stability Theory. https://ivv5hpp.uni-muenster.de/u/baysm/repos/MMM-GST/mmm-gst.pdf