

Matroids and configuration spaces

PRESENTATION OF THE COURSE

Matroids are combinatorial structures satisfying axioms that encapsulate the notion of linear dependence for a list of vectors. Since its origins in the 1930s, matroid theory has enjoyed close connections to graph theory, optimization, and computer science; in recent years, however, it proved to have a rich interplay also with algebraic geometry, tropical geometry, and commutative algebra. For instance, Hodge-theoretic techniques allowed to prove important log-concavity results. Also topology naturally comes into the play: indeed, the cohomology of many configuration spaces is deeply influenced by the underlying matroids; the prototypical case of hyperplane arrangements is being generalized to a wider class called abelian arrangements. The visit of two experts in the field, Prof. Federico Ardila from San Francisco State University and Prof. Emanuele Delucchi from Université de Fribourg, will provide the possibility to learn more on this rapidly developing subject. Moreover, Prof. Luca Migliorini will provide the Hodge-theoretic ideas on which the log-concavity results rely, while Prof. Luca Moci will provide background material and outline further applications.

PLAN OF THE COURSE

The course is divided in four parts:

1. An introduction to matroids (L. Moci)
Sept. 26th and October 3rd (thursday) from 14:00 to 16:00 Aula VIII piano.
(This part may be skipped by those who are already familiar with the basic notions).
2. The geometry of matroids (F. Ardila)
October 8, 15, 22, (tuesday) from 14:00 to 16:00, aula Vitali.
3. Abelian arrangements (E. Delucchi)
Four lectures in November: dates will be announced soon.
4. Hodge theory and log-concavity conjectures (L. Migliorini, L. Moci)
December-February. A more precise plan will be announced as soon as possible.