Centro di Ricerca Matematica "Ennio De Giorgi"

Intensive research period
May - June 2010
Configuration Spaces: Geometry, Combinatorics and Topology

Mini-courses

Preliminary list of courses

Sergey Yuzvinsky: *A short introduction to arrangements of hyperplanes - May 5-6,* Sala Conferenze

Stefan Papadima, Alex Suciu: *Cohomology jumping loci and homological finiteness properties - May 10-14,* (for the seminar rooms see the timetable)

Sergey Yuzvinsky: *Resonance varieties for arrangements and their relations to combinatorics and algebraic geometry - May 10-11,* Aula Dini

Claudio Procesi: *Splines and partition functions - May 17-21,* (for the seminar rooms see the timetable)

Fred Cohen: *Moment-angle complexes, their stable structure and cohomology - May 31-June 4,* Aula Dini

Eduard Looijenga: *Aspects of the KZ system - May 31-June 4,* Aula Dini

Alexander Varchenko: *The quantum integrable model of an arrangement of hyperplanes - June 7-11,* Aula Dini

Dev Sinha: *Hopf rings in topology and algebra - June 14-18,* Aula Dini

Michèle Vergne: *Remarks on Box splines - June 14-18,* Aula Dini

last update: May 17, 2010

Configuration spaces: mini courses

Timetable

May 2010

Monday	Tuesday	Wednesday	Thursday	Friday
3	**4**	**5** 10:30-12:00 *Yuzvinsky* (Confer.) 12:00-12:30 *Welcome cocktail*	**6** 10:30 Coffee break 11:00-12:30 (Confer.) *Yuzvinsky*	**7**
10 9:30-11:00 *Suciu* (Dini) 11:00 Coffee break 11.15-12.45 *Yuzvinsky* (Dini)	**11** 9:30-11:00 *Suciu* (Dini) 11:00 Coffee break 11.15-12.45 *Yuzvinsky* (Dini)	**12** 10:45 Coffee break 11.15-12.45 *Papadima* (Bianchi)	**13** 10:45 Coffee break 11.15-12.45 *Papadima* (Dini)	**14** 10:45 Coffee break 11:15-12:45 *Suciu* (Conferenze)
17 10:30 Coffee break 11:00-12:30 *Procesi* (Dini)	**18** 10:30 Coffee break 11:00-12:30 *Procesi* (Stemmi)	**19**	**20** 9:30-11:00 *Procesi* (Stemmi) 11:00 Coffee break	**21** 10:30 Coffee break 11:00-12:30 *Procesi* (Bianchi)
24 WORKSHOP	**25** WORKSHOP	**26** WORKSHOP	**27**	**28**

Configuration spaces: mini courses

Timetable

May-June 2010

Monday	Tuesday	Wednesday	Thursday	Friday
31 (May) 9:30-11:00 Cohen (Dini) 11:00 Coffee break 11:15-12:45 Looijenga (Dini)	**1 (June)** 9:30-11:00 Cohen (Dini) 11:00 Coffee break 11:15-12:45 Looijenga (Dini)	**2** HOLIDAY	**3** 9:30-11:00 Looijenga (Dini) 11:00 Coffee break 11:15-12:45 Cohen (Dini)	**4** 9:30-11:00 Looijenga (Dini) 11:00 Coffee break 11:15-12:45 Cohen (Dini)
7 10:30 Coffee break 11:00-12:30 Varchenko (Dini)	**8** 10:30 Coffee break 11:00-12:30 Varchenko (Dini)	**9** 10:30 Coffee break 11:00-12:30 Varchenko (Dini)	**10** 10:30 Coffee break 11:00-12:30 Varchenko (Dini)	**11** 10:30 Coffee break 11:00-12:30 Varchenko (Dini)
14 10:30 Coffee break 11:00-12:30 Vergne (Dini) 16:00-17:00 Sinha (Dini)	**15** 9:30-11:00 Vergne (Dini) 11:00 Coffee break 11:15-12:45 Sinha (Dini)	**16** 9:30-11:00 Sinha (Dini) 11:00 Coffee break 11:15-12:45 Vergne (Dini)	**17** HOLIDAY	**18** 9:30-11:00 Sinha (Dini) 11:00 Coffee break 11:15-12:45 Vergne (Dini)
21 WORKSHOP	**22** WORKSHOP	**23** WORKSHOP	**24** WORKSHOP	**25** WORKSHOP

Abstracts of the courses:

A short introduction to arrangements of hyperplanes
(May 5-6, Sala Conferenze)
Sergey Yuzvinsky - University of Oregon, Eugene

Cohomology jumping loci and homological finiteness properties
(May 10-14, Aula Dini)
Stefan Papadima - Institute of Mathematics "Simion Stoilow" of the Romanian Academy, Bucharest
Alex Suciu - Northeastern University, Boston

1 Homology of local systems and characteristic varieties

2 Homology of free abelian covers

3 Resonance varieties, tangent cones, formality

4 Bieri-Neumann-Strebel-Renz invariants

5 Applications:

    a Knots, links, and 3-dimensional manifolds,

    b Right-angled Artin groups and toric complexes,

    c Kahler and quasi-Kahler manifolds,

    d Hyperplane arrangements

Resonance varieties for arrangements and their relations to combinatorics and algebraic geometry
(May 10-11, Aula Dini)
Sergey Yuzvinsky - University of Oregon, Eugene

Splines and partition functions
(May 17-21, for the seminar room, see the timetable)
Claudio Procesi - Universitá "La Sapienza" Roma

I will discuss several constructions one can perform starting from a list of vectors and show how some ideas coming from the theory of hyperplane arrangements come into play in numerical analysis and arithmetic. The material is based on a forthcoming book with De Concini, preliminary version available at `www.mat.uniroma1.it/~procesi/dida.html`: Hyperplane arrangements, polytopes, box-splines.

Moment-angle complexes, their stable structure and cohomology
(May 31-June 4, Aula Dini)
Fred Cohen - University of Rochester, Rochester

Aspects of the KZ system
(May 31-June 4, Aula Dini)
Eduard Looijenga - Universiteit Utrecht

The goal of this minicourse is to show how this local system can be understood in algebro-geometric terms. We will also discuss certain important subsystems (known as Hitchin or WZW systems). It has been conjectured that these subsystems have a flat inner product. We will verify this, essentially following Ramadas, that this is so when one the input data (a simple Lie algebra) is $SL(2)$.

The quantum integrable model of an arrangement of hyperplanes
(June 7-11, Aula Dini)
Alexander Varchenko - University of North Carolina at Chapel Hill

Hopf rings in topology and algebra
(June 14-18, Aula Dini)
Dev Sinha - University of Oregon

We start with some topics very close to the theme of the workshop, namely the cohomology of unordered configuration spaces and in particular of symmetric groups, as recently studied by Giusti, Salvatore and myself. A key organizing concept is that of a Hopf ring, which is a ring object in the category of coaglebras. This notion has been mostly applied in the study of homology of spaces which represent multiplicative cohomology theories such as Eilenberg- -MacClane spaces or infinite Grassmannians. But we have found that this structure also applies to cohomology, representation theory, and invariant theory of finite "series groups" such as symmetric or alternating groups and general linear groups over finite fields. We both revisit some classical topics and indicate some open areas of investigation stemming from these ideas.

Remarks on Box splines
(June 14-18, Aula Dini)
Michèle Vergne - Centre National de la Recherche Scientifique Ecole Polytechnique. Centre de Mathematiques Laurent Schwartz

Location

Most of the lectures will take place in Sala Conferenze, inside Collegio Puteano (number 2 in the map below) or in Aula Dini, inside Palazzo del Castelletto (number 1 in the map below). Some lectures will take place in Aula Bianchi or in Aula Stemmi, inside Palazzo della Carovana (number 3 in the picture). Look also at http://www.crm.sns.it/hpp/practical/maps.html.

Table 1: Map with the location of Palazzo del Castelletto (number 1), Collegio Puteano (number 2) and Palazzo della Carovana (number 3)