Università di Roma Tor Vergata

# Department of Mathematics

# University of Rome Tor Vergata

# MATH@TOV

## Excellence Project 2018-2022

## NEWSLETTER

## N°3 – October – December 2018

Edited by: M. Abundo, L. Arosio, D. Bartolucci, L. Caramellino, T. D'Aprile, F. Flamini, E. Gandola.

# Presentation

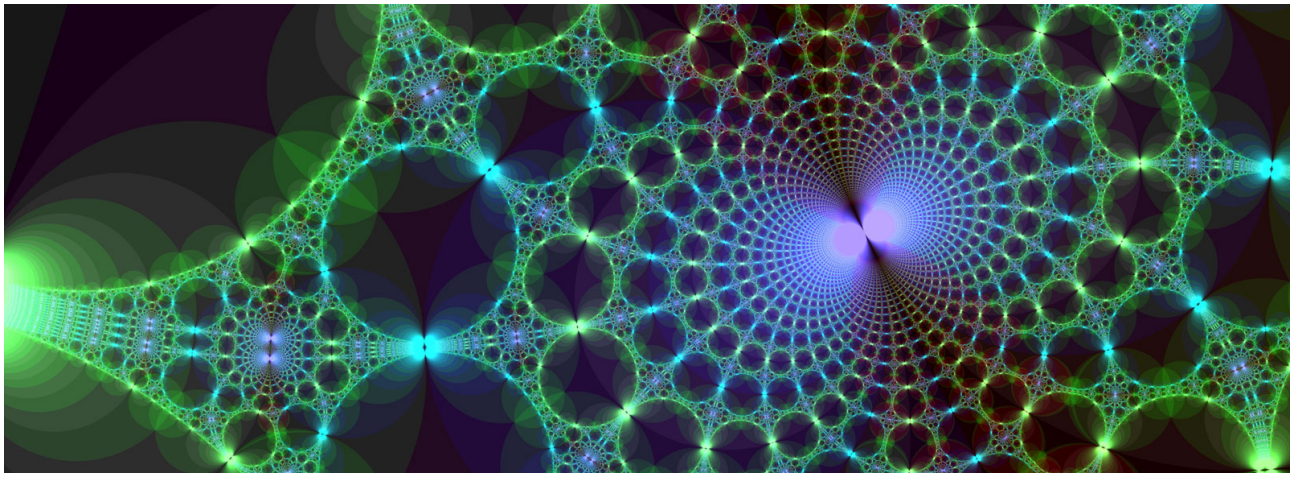
The Department of Mathematics of the University of Rome Tor Vergata is distinguished by first class research, often motivated by applications from theoretical physics, astronomy, aerospace, finance, technology and medical science, a high level educational system, and the organization of events in the context of the so-called third mission of the University. For details we refer to the Department's website, http://www.mat.uniroma2.it

The Department aims to increase its leading role in research, math education and math culture. The recently awarded national Excellence Project 2018-2022, denoted by MATH@TOV, offers the opportunity to face new challenges, and its main objectives are:

- foster new collaborations between staff members on advanced research themes
- hire excellent staff members, able to participate in multiple research projects
- stimulate the interaction with excellent math groups, both in public research institutions and industry, and transform the Department into a strategic asset for the development of highly advanced mathematics and its application to specific problems
- increase the international visibility of the Department
- improve the Master and PhD Programs in Mathematics
- intensify the spreading of Math Culture.

See the web page of the project MATH@TOV: http://www.mat.uniroma2.it/Progetto/

# Recruitment



MIUR Excellence Grant (CUP E83C18000100006, 2018-2022), awarded by the Mathematics Department of the University of Rome Tor Vergata (project MATH@TOV ), provides funds for Assistant and Associate Professorships as well as for Postdoc Positions. The list below deals with positions for the first year of the project.

## Professorships

- In July 2018, Central Administration of the University confirmed 2 “Tenure-Track” Assistant Professorships (RTD-B) as follows:

  - 1 position in Geometry (Settore concorsuale 01/A2-Settore Scientifico Disciplinare MAT/03)

  - 1 position in Numerical Analysis (Settore concorsuale 01/A5-Settore Scientifico Disciplinare MAT/08)

  See
  http://www.uniroma2.it/ammin/senato/2018/23-07-18/10_4.pdf
  and
  http://www.uniroma2.it/ammin/cda/2018/24-07-18/15_6.pdf

  Both positions are for three years and, after evaluation, can be converted in tenured Associate Professorships; they will be opened not early than 2019 and will be awarded through a public competition.

  Applicants must have at least three years of experience after PhD completion, and an already established research record.

  Selection procedures are in progress.

  More information will appear soon on http://www.mat.uniroma2.it/Progetto/recruitment.php

- In December 2018, Central Administration of the University of Rome Tor Vergata confirmed 1 position in Mathematical Analysis (Settore concorsuale 01/A3-Settore Scientifico Disciplinare MAT/05).

See
http://www.uniroma2.it/ammin/senato/2018/14-12-18/08_2.pdf
and
http://www.uniroma2.it/ammin/cda/2018/17-12-18/Risultati.pdf

The position will be awarded through a public competition.

To apply, candidates must either hold the "Abilitazione Scientifica Nazionale" (Italian National Habilitation, see http://abilitazione.miur.it/public/index.php ) as Associate Professor, or be declared eligible by the Italian Ministry of University and Research (MIUR), or be currently employed in an equivalent position in Italy or in a foreign Department.

Applicants should have an established track-record of publications in top international journals and evidence of leadership and recognition in the international academic community, including grant applications and project management. Standards of excellence in teaching are also expected.

More information will appear soon on http://www.mat.uniroma2.it/Progetto/recruitment.php

## Postdoc positions

- In November 2018, Central Administration of the University of Rome Tor Vergata confirmed the following one-year Postdoc positions (Assegni di Ricerca - III Fascia):

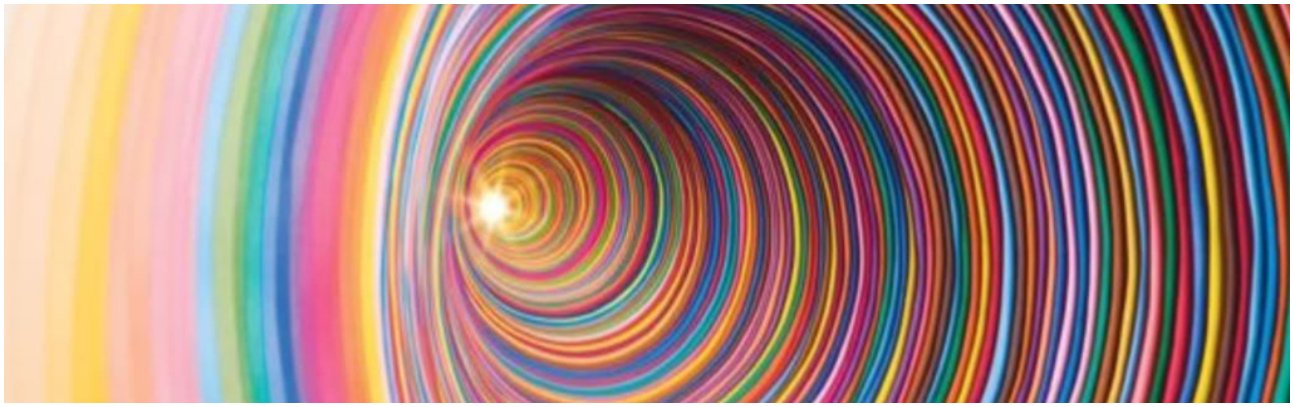
- 1 position in Probability and Statistics (Settore Scientifico Disciplinare MAT/06) - Title: "Geometry of random fields and astrostatistical applications"
- 1 position in Mathematical Physics (Settore Scientifico Disciplinare MAT/07) - Title: "Statistical properties of dynamical systems"

See
http://concorsionline.uniroma2.it/?mod=main&do=getInCorso

Three further Postdoc positions (in other sub-disciplines), which are related to the first year of the project, will be given later on.

More information will appear soon on http://www.mat.uniroma2.it/Progetto/recruitment.php

# Research



## Thematic Semesters

During the period October 2018 - March 2019, MATH@TOV organises a thematic semester with a series of seminar talks on the following main areas (cf. also http://www.mat.uniroma2.it/Progetto/short-visit.php ):

**Operator Algebras and Quantum Field Theory**

- Among others, we plan to have the following speakers: Gwyn Bellamy (Scotland), Pierre Bieliavsky (Louvain, Belgium), Detlev Buchholz (Gottingen, Germany), Ken Dykema (Texas, USA), Ghislain Fourier (Germany), Klaus Fredenhagen (Hamburg, Germany), Benoit Fresse (France), Michael Magee (UK), Ryszard Nest (Copenhagen, Denmark), Nicola Pinamonti (Genova, Italy), Wolfgang Soergel (Germany), Layla Sorkatty (Sudan).

**Holomorphic dynamics and geometry of complex manifolds and spaces, and their interplay**

- Among others, we will have seminar talks of Marco Abate (Pisa, Italy), Alberto Abbondandolo (Germany), Cinzia Bisi (Ferrara, Italy), Manuel Contreras (Spain), Eleonora Di Nezza (France), Hakan Samuelsson Kalm (Sweden), Likas Kosinski (Poland), Frank Kutzchebausch (Switzerland), Fulvio Ricci (SNS Pisa, Italy), Tatsuo Suwa (Japan), Adriano Tomassini (Parma, Italy), Erlend Wold (Norway), Andrew Zimmer (USA).

**Mathematical techniques for Earth and Space Science**

- Among others, we plan to have the following speakers: Mauro Carfora (Italy), Anna Maria Cherubini (Italy), Cristel Chandre (France), Guido Ciraolo (France), Yabebal Fantaye (South Africa), Helene Frankowska (France), Catalin Gales (Romania), M. Patrick Martinez (France), Sokol Ndreca (Brazil), Rocio Isabel Paez (Italy), Alicia Simon-Petit (France), Giovanna Tinetti (UK).

**PDE's of Liouville type in Physics and Geometry**

- Within MATH@TOV we shall have, among others, Marcello Lucia (CUNY New-York, USA), Zheng Huang (CUNY New-York, USA), Masayasu Mimura (Japan), Jingang Xiong (Beijing Normal Univ.). They will deliver seminars on the immersion problem for minimal surfaces.

# Conferences and Workshops

MATH@TOV is funding a wide activity of conferences/workshops/advanced lecture series/schools. Recent and next events are listed below.

1) **Mini Workshop - Representation Theory in Rome and Beyond.**
   Link: https://sites.google.com/view/reptheoryromeandbeyond19/home
   Venue and Period: Department of Mathematics, University of Rome Tor Vergata, November 16, 2018

   **Invited Speakers**
   - Michel Brion (U. Grenoble des Alpes, France)
     - Title: "Automorphisms of almost homogeneous varieties"
   - Michèle Vergne (Inst. Math. Jussieu - Paris Rive Gauche, France)
     - Title: "Quiver Grassmannians, Q-intersection and Horn conditions "
   - Peter Littelmann (U. Köln, Germany)
     - Title: "Standard Monomial Theory via Newton-Okounkov Theory"

   **Scientific and Organizing Committee**
   F. Gavarini, M. Lanini

2) **International Workshop - Analysis, Control and Inverse Problems for PDEs**
   Link: http://www.dma.unina.it/floridia/ControlPDEs2018/scope.html
   Venue and Period: University of Naples "Federico II", Naples, November 26-30, 2018

   The international workshop aimed for bringing together researchers working on a wide range of subjects in applied Mathematics, including Control and Stabilization of Partial Differential Equations (PDE), Optimal Control, Shape Optimization, Inverse Problems for PDEs, Numerical Analysis of Control Problems, in order to foster the opportunity to share recent results, techniques, ideas and projects related to the different areas represented among the participants.

   The invited speakers have been divided in:
   Plenary speakers (the plenary lectures are 40 minutes long)
   Senior invited speakers in two parallel sessions (the talks are 25 minutes long)
   Junior invited speakers in two parallel sessions (the junior talks are 15 minutes long)

   **Scientific Committee**
   P. Cannarsa (President of the SC, U. Rome Tor Vergata), F. Alabau-Boussouira (U. Lorraine & Sorbonne U.), F. Ancona (University of Padova), S. Bertoluzza (CNR IMATI Pavia), G. Buttazzo (U. Pisa), J.M. Coron (Sorbonne U.), L. Grune (U. Bayreuth), G. Leugering (U. Erlangen-Nuremberg), C. Sbordone (U. Naples Federico II), M. Yamamoto (U. Tokyo)

   **Organizing Committee**
   G. Floridia (U. Naples Federico II), R. Guglielmi (GSSI, L'Aquila), C. Pignotti (U. L'Aquila)

3) **Mini Workshop - Symulations of Plasma Dynamics in Tokamaks.**
   Link: https://www.mat.uniroma2.it/Progetto/ideas2019.php
   Venue and Period: Department of Mathematics, University of Rome Tor Vergata, January 23, 2019

   **Invited Speakers**
   - Cristel Chandre (U. Aix-Marseille, France)
     - Title: "A brief introduction to gyrokinetics"

- Philippe Ghendrih (Commissariat à l'énergie atomique - Institut de Recherche sur la Fusion par confinement Magnétique, Cadarache, France)
    - Title: "Kinetics and gyrokinetics to understand turbulent heat transport in burning thermonuclear plasmas"
- Ahmed Ratnani (Max Planck Institute for Plasma Physics, Germany)
    - Title: "Challenges in the numerical simulation of MHD"

**Scientific and Organizing Committee**
M. Bertsch, U. Locatelli, C. Manni, F. Pelosi, H. Speelers

**4) Mini Workshop - The Geometry of Random Fields**
Venue and Period: Department of Mathematics, University of Rome Tor Vergata, January 25, 2019

**Invited Speakers**
- Dmitry Belyaev (Oxford University, UK)
    - Title: “Geometry of smooth Gaussian fields and percolation”
- Igor Wigman (King's College London, UK)
    - Title: “Points on nodal lines with given direction”
- Anne Estrade (U. Paris Descartes, France)
    - Title: “On Berry's dislocation lines in 3D framework”
- Maurizia Rossi (Università di Pisa, Italy)
    - Title: “Nodal lengths of random spherical harmonics”

**5) Workshop - DYNAMICAL SYSTEMS: FROM GEOMETRY TO MECHANICS**
Link: http://www.mat.uniroma2.it/Progetto/bridge2019.php
Venue and Period: Department of Mathematics, University of Rome Tor Vergata, February 5-8, 2019

This workshop aims to provide a forum for discussion, exchange and collaboration on the most recent advances in dynamical systems, from different perspectives. Addressed topics include: Complex Dynamics, Ergodic Theory, Hamiltonian and Symplectic Dynamics, Smooth dynamics, Topological Dynamics.

**Invited Speakers**
- Marie-Claude Arnaud (Université d'Avignon, France)
- Viviane Baladi (IMJ-PRG, SorbonneUniversité, France)
- Eric Bedford (Stony Brook University, United States of America)
- Pierre Berger (Université Paris 13, France)
- Rafael de la Llave (Georgia Institute of Technology, United States of America)
- Santiago Diaz Madrigal (Universidad de Sevilla, Spain)
- Dmitry Dolgopyat (University of Maryland, United States of America)
- Christos Efthymiopolus: (Academy of Athens, Greece)
- Nuria Fagella (Universitat de Barcelona, Spain)
- Albert Fathi (Georgia Institute of Technology, United States of America)
- John Erik Fornaess (Norwegian University of Science and Technology, Norway)
- Vadim Kaloshin (University of Maryland, United States of America)
- Stefano Luzzatto (Abdus Salam International Centre for Theoretical Physics (ICTP), Italy)
- Stefano Marmi (Scuola Normale Superiore di Pisa, Italy)
- Gabriella Pinzari (Università degli Studi di Padova, Italy)
- Jasmin Raissy (Université de Toulouse, France)
- David Sauzin (CNRS-IMCCE, France)

- Tere M-Seara (Universitat Politécnica de Catalunya, Spain)
- Amie Wilkinson (University of Chicago, United States of America)

**Scientific and Organizing Committee**
F. Bracci, A.Celletti, C.Liverani, A. Sorrentino

**6) Workshop - 43RD LQP. FOUNDATIONS AND CONSTRUCTIVE ASPECTS OF QFT.**
Link: https://sites.google.com/view/43-lqp
Venue and Period: Galileo Galilei Institute, Florence, Italy, February 20-22 2019

The workshop is particularly directed to young researchers and PhD students; it will be held at the *Galilei Institute* in Florence, within the collaboration frame between the *Center for Mathematics and Theoretical Physics* of our Department and the *National Institute for Nuclear Physics.*

**Scientific and Organizing committee**
M. P. Lombardo (INFN, Florence), R. Longo (Rome Tor Vergata), V. Morinelli (Rome Tor Vergata), G. Morsella (Rome Tor Vergata), G. Ruzzi (Rome Tor Vergata)

**7) Workshop - MATHEMATICAL MODELS AND METHODS IN EARTH AND SPACE SCIENCES**
Link: http://www.mat.uniroma2.it/Progetto/mmmess19.php
Venue and Period: Department of Mathematics, University of Rome Tor Vergata, March 19-22, 2019

The workshop aims to provide a forum for discussion, exchange and collaboration on the most recent mathematical developments in earth and space sciences. Addressed topics include: mathematical models for space debris and air traffic stability of planets and satellites data analysis in cosmology, numerical techniques in plasma physics, uncertainty quantification, mathematical models in climatology

**Invited Speakers**
- Ethan Anderes (University of California at Davis, USA)
- Yosh Ashkenazy (Ben-Gurion University of the Negev, Israel)
- Roberto Battiston (Agenzia Spaziale Italiana, Italy)
- Annalisa Bracco (Georgia Institute of Technology, USA)
- Camilla Colombo (Politecnico di Milano, Italy)
- Tor Dokken (SINTEF, Norway)
- Giovanni Gronchi (Università di Pisa, Italy)
- Silvio Gualdi (CMCC, Bologna, Italy)
- Àngel Jorba (Universitat de Barcelona, Spain)
- Angela Kunoth (Universität zu Köln, Germany)
- Daniela Mansutti (IAC-CNR, Roma, Italy)
- Jason McEwen (University College, London, UK)
- Salvatore Miccichè (Università di Palermo, Italy)
- Antonello Provenzale (IGG-CNR, Pisa, Italy)
- Eric Sonnendrücker (IPP, Garching, Germany)
- Jean-Luc Starck (CEA, Paris-Saclay, France)
- Emmanuel Trélat (Sorbonne Université - Paris 6, France)
- Massimiliano Vasile (University of Strathclyde, Glasgow, UK)

**Scientific and Organizing Committee**
M. Bertsch, P. Cannarsa, A. Celletti, C. Manni, D. Marinucci, M. Picardello, B. Scoppola, A. Sorrentino, H. Speleers

## Advanced Lecture Series, Scientific Schools

1) **School (Advanced Lectures) - "The Interplay of Geometric Modelling and Numerical Analysis of PDEs. A short course by Annalisa Buffa"**
   Link: http://www.mat.uniroma2.it/~dott/Buffa.html
   Venue and Period: Department of Mathematics, University of Rome Tor Vergata, January 25-26, 2019

2) **School (Advanced Lectures) - "Variational Approaches in PDE's"**
   Link: http://www.mat.uniroma2.it/~ricerca/analis/Scuola_Marzo_2019/
   Venue and Period: Department of Mathematics, University of Rome Tor Vergata, March 13-14, 2019

   Registration is necessary for organizational purposes; applicants should use the web-page: http://www.mat.uniroma2.it/~ricerca/analis/Scuola_Marzo_2019/home.html

Courses:
- Thomas Bartsch (Universität Gießen, Germany)
  - Title: "Normalized solutions of nonlinear Schrödinger equations and systems"
- Tristane Riviere (ETH Zurich, Switzerland)
  - Title: "Minmax methods for the area of surfaces"

Short talks:
- Dario Mazzoleni (U. Cattolica di Brescia, Italy)
  - Title: "Asymptotic spherical shapes in some spectral optimization problems"
- Roberta Musina (U. Udine, Italy)
  - Title: "Some advances on Arnold's problem about the existence of multiple geodesics"
- Alessandro Pigati (ETH Zurich, Switzerland)
  - Title: TBA
- Pieralberto Sicbaldi (U. Granada, Spain)
  - Title: "Overdetermined elliptic problems in exterior domains"

**Scientific and Organizing Committee**
R. Molle, G. Tarantello, G. Verzini

## Publications

Publications realized, within the excellence Department project MATH@TOV, by members of the Department and their co-authors during the first year of the project have been listed in the web-page http://www.mat.uniroma2.it/Progetto/publications.php

# High levelteaching activities

## PhD School in Mathematics - Cuozzo Prize

The Department of Mathematics hosted the "**Cuozzo Prize**" for young PhD graduates in Mathematics, sponsored by Vincenzo and Stefania Cuozzo, in memory of Michele Cuozzo.

Application Call has been published at the web page:
http://www.mat.uniroma2.it/~lucia/Docs_avvisi-dip/PremioCuozzo2018_prot.pdf

The prize has been awarded by Dott. Andrea Giorgini, who has been invited to present a lecture at the **Department Day** on December 19, 2018.

## PhD School in Mathematics - Courses

Special courses for the Ph.D. School in Mathematics, to be held in the period April-October 2019, organized within the excellence Department project MATH@TOV are the following:

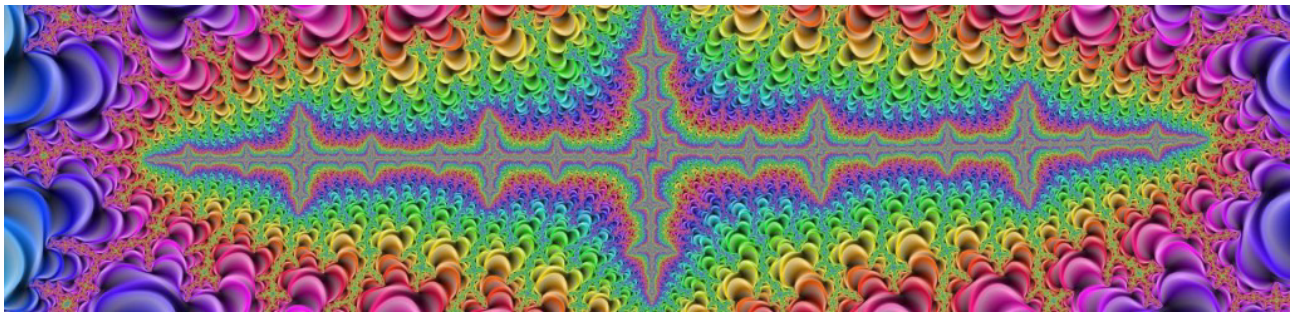
- Vlad Bally (Université Paris-Est, France)
  - Title: "Malliavin calculus and regularity properties" (Probability theory and Statistics, PDE)
- Barbara Bolognese (University of Sheffield, UK)
  - Title: "Introduction to Bridgeland stability and applications" (Algebraic Geometry)
- Sylvain Cappell (New York University, USA)
  - Title: " Theories of characteristic classes for singular varieties and their roles and computations in geometrical topology and algebraic geometry" (Algebraic Geometry)
- Dejan Slepcev (Carnegie-Mellon University, USA)
  - Title: "Variational problems of Machine Learning and their continuum limits" (PDE)

## Master-Thesis prizes

- MATH@TOV provided funds for 10 Master-Thesis prizes, for an amount of 2,000.00 euros each, dedicated to Master's Graduates in Pure and Applied Mathematics at Tor Vergata, who defended their theses in the period July 2016-May 2018. The awards were aimed at master's theses satisfying at least one of the following conditions: a significantly original result; an efficient implementation and/or a particularly significant numerical experimentation; a clear and in-depth presentation of highly significant results. The following master's graduates have been awarded:

    - Chiara CARACCIOLO:"Studio rigoroso della stabilità C effettiva di sistemi Hamiltoniani quasi-integrabili: stime computer-assisted"
    - Marco CARFAGNINI:"Random fields on Riemannian manifolds: the Gaussian kinematic formula"
    - Giorgio CIPOLLONI: "Deterministic walks"
    - Danilo DEL VESCOVO:"On first passage-time and first-passage area of some one-dimensional diffusion processes"
    - Matteo FIACCHI: "Embedding problems in Loewner theory in higher dimensions"
    - Jacopo GAROFALI: "Dynamical systems admitting a parallel tensor"
    - Daniele GIOIOSA: "Uno schema Semi-Lagrangiano ibrido per opzioni asiatiche nel modello di Heston"
    - Roberto MASTROPIETRO: "Spectral analysis of isogeometric multi-patch discretizations"
    - Francesco RECUPERO:"Parabolic Kazhdan-Lusztig polynomials for quasi-minuscule quotients"
    - Antonio TRIBUZIO:"Perturbazioni di movimenti minimizzanti e curve di massima pendenza"

# General Activities



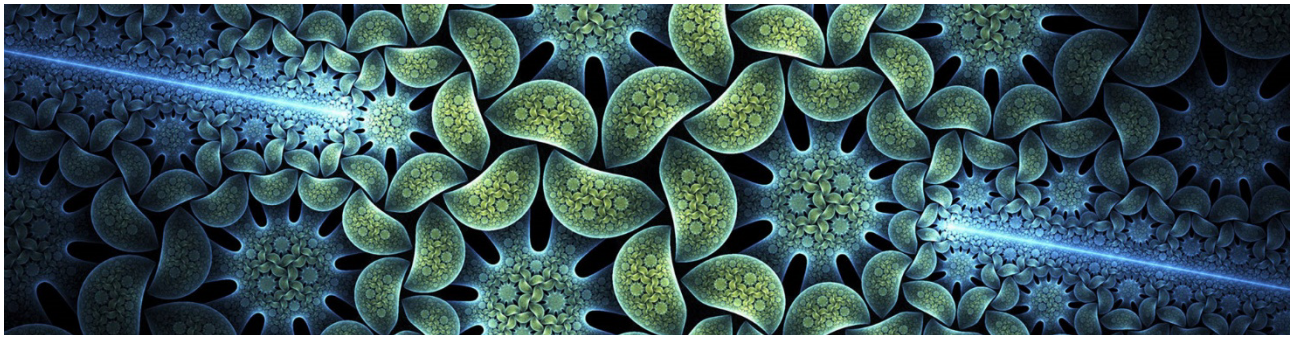
MATH@TOV is also meant to fund renovations of rooms/laboratories of the Department, acquisition of modern equipment, research books, etc. The list below covers some of the activities in the first year of the project.

- BUILDING:
  Extension of "Dal Passo" room, with sliding panels;
  Realization of a "Department Common Room";
  "Photographic Laboratory" renovation;
  "Computing Center Area" renovation, where the multi-core "Single System Image" will be located for CPU parallel computing. CPU will be used also by the Department of Economy, University of Rome Tor Vergata

- SOFTWARE:
  it is now possible to install and use *Mathematica* on desktops or laptops connected to the University network. The procedure is still under experimental evaluation, however installation on PCs of an IT laboratory classroom have been worked.

- COMPUTATIONAL EQUIPMENT:
  2 chassis, each of which equipped with 4 processors, for a total of 144 cores, which can be used in parallel. It is reasonable to expect that this new resource will be fully available for the end of April/ early May. The architecture of the "single system image" machine is absolutely modular and can be expanded in the future by purchasing other chassis with similar characteristics of the first two.

# Third mission



- From 26 to 28 October 2018, the Department of Mathematics organized the third edition of the "*Autumn School*" in San Martino al Cimino (VT). 50 secondary school teachers participated to the school.

- In the period October-December 2018, E. Callegari, G. Marini and A. Rapagnetta have held meetings of preparation for Math Competitions, aimed at students and teachers of high schools. Lessons and explanations are available at http://www.problemisvolti.it/StageOlimpiadiMatematica.html

- In November 2018, D. Pasquazi held a training course for secondary school teachers, on the theme "*Leonardo da Vinci's geometric approach to concepts of area and equivalence*".

- R. Longo participated as speakers to the International Conference "*The Origins and Evolution of Space-Time*" held at Pontifical Lateran University, Vatican City, on November 27-28, 2018 https://www.pul.it/event/international-conference-the-origins-and-evolution-of-space-time/

- Concerning *Visiting Professors from Third World Countries*, MATH@TOV provided funds for the short-term visitor Yabebal Fantaye, from the African Institute for Mathematical Science, South Africa. Research interest: statistical properties of the Universe using the Cosmic Microwave Background (CMB) and Big Data analysis.

- Comitato Unico di Garanzia (CUG) of the University of Rome Tor Vergata has organized the series of conferences and laboratory activities "*STEM UP!",* dealing with approach to secondary school of children, with particular attention to gender issues. Schools involved are Liceo Lucrezio Caro and Liceo Augusto in Rome. Part of the activities are structured in a project of "*Alternanza Scuola-Lavoro*" with Liceo Augusto in Rome, started on December 19, 2018 with interventions on the professional career in Mathematics and Biology.

- Meetings with teachers have continued, as part of the initiatives "*Con la Mente e con le Mani*" and "*Curriculum verticale*", organized in collaboration with *Accademia Nazionale dei Lincei* in Rome and the city of Viterbo. C. Ciliberto organises initiatives, with collaboration of D. Pasquazi, B. Scoppola and F. Tovena. At the same time, further meetings dedicated to teachers are organized in the framework of "*Network 33*".