Algebraic Geometry at IMAR: past and present research

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1. History of Algebraic Geometry group at IMAR

- ▶ Professor Gheorghe Galbura was the first romanian mathematician working in Algebraic Geometry domain.
- ▶ He was a PhD student of Francesco Severi and passed the examination in 1942 at Universita di Roma La Sapienza with the thesis: "Sull gruppo caratteristico di una corrispondenza fra varieta algebriche".
- ▶ Gheorghe Galbura was the first Head of the Algebraic Geometry group at IMAR, (the Institute of Mathematics of the Romanian Academy), created around 1955.
- ▶ He published the first book of Algebraic Geometry in Romanian in 1961: "Fields of algebraic functions and algebraic varieties".

- At that time the algebraic geometry was on the foundations of italian school and of the book of Andre Weil.
- After 1960, the romanian mathematicians learned about the papers of Jean-Pierre Serre, Henri Cartan, Friederich Hirzebruch and Alexander Grothendieck. All the foundations of algebraic geometry changed drastically and professors learned together with their students the new algebraic geometry, especially, in the sense of Grothendieck.

2. Scientific seminar and people

Algebraic Geometry, each Thursday, from 10 to 12, at the Institute.

- ▶ The professor Gheorghe Galbura, together with professors Alexandru Lascu and Ionel Bucur, initiated the group and the seminar after 1955.
- ▶ The members of the Department of Mathematics of the University of Bucharest are regularly attending the seminar.
- ▶ Several students from terminal years of the University also participate in the seminars.
- ▶ The members of the group are currently giving advanced courses at the Department of Mathematics of the University of Bucharest and supervise Master and Ph.D. Thesis in the field.

- ▶ Late former members of the group were the following: Gheorghe Galbura, Alexandru Lascu, Ionel Bucur, Constantin Banica, Lucian Badescu, Octavian Stanasila, Mihnea Moroianu, Ciprian Borcea, Adrian Constantinescu.

- ▶ Some former members of the group are now spread at several Universities all over the world: Alexandru Buium, Alexandru Dimca, Andras Nemethi, Matei Toma, Florian Pop, Mihai Putinar, Mircea Mustata, Mihnea Popa, Andrei Negut, Claudiu Raicu, Mihai Fulger, Laurentiu Maxim, Alexandru Constantinescu.

- ▶ All of them come to IMAR for research visits and collaborations with the present members of the group.

- ▶ Retired members of the group are the following: Nicolae Manolache, Paul Flondor, Paltin Ionescu, Serban Barcanescu, Nae Buruiana.

Current members of the Algebraic Geometry group are:
Florin Ambro, Cristian Anghel, Marian Aprodu,
Mugurel Barcau, Vasile Brinzanescu, Filip Chindea,
Mario Maican, Mihai-Cosmin Pavel, Calin-Daniel Spiridon.

3. Past and current general research subjects

- ► Classification of small codimensional projective varieties and adjunction theory.
- ► Algebraic and analytic surfaces.
- ► Space curves.
- ► Formal functions and Barth-Lefschetz type results.
- ► Vector bundles over algebraic and analytic varieties.
- ► Algebraic cycles on abelian varieties.
- ► Graded algebras associated to Cartier divisors on algebraic varieties.

4. Recent research subjects

- Stacks, algebraic stacks and moduli problems.
- Holomorphic vector bundles on complex surfaces.
- Twisted Fourier-Mukai transforms and moduli spaces of sheaves on surfaces and principal bundles.
- Catlin and D'Angelo q-type invariants in the $\overline{\partial}$-problem on domains in $\mathbb{C}^n$.
- Koszul modules and resonance schemes.
- Koszul cohomology and applications to moduli.
- Green's conjecture.
- Ulrich bundles on surfaces.

- Successive minima of line bundles.
- Fano varieties, their geometry and moduli.
- Toric Fano fibrations.
- Vector bundles on projective spaces.
- 4 - instantons.
- Ribbon structures ans symplectic Lie pairs.
- Bridges connecting encryption schemes.
- Isogeny covariant differential modular forms and the space of elliptic curves up to isogeny.

- Intersection homology and Alexander modules of hypersurface complements.
- Morse numbers of complex polynomials.
- Brylinski-Radon transformations and generic projections.
- Equivariant toric geometry.
- Moduli spaces of rank-2 instantons sheaves.
- Geometry of Hilbert schemes.
- Fitting structure of a resonance scheme associated to a graph and to Koszul modules.

- ACM bundles on abelian surfaces.
- Ulrich bundles on curves.
- Projective moduli spaces of sheaves via restriction theorems.
- Compactification of moduli of vector bundles.