H.F.R.I.
Hellenic Foundation for Research & Innovation

Description of the funded research project

1st Call for H.F.R.I. Research Projects to Support Faculty Members & Researchers and Procure High-Value Research Equipment

Title of the research project: Finiteness Conditions in Homological Algebra: Interactions and Applications

Principal Investigator: Ioannis Emmanouil

Reader-friendly title: FiCiHAlgIA

Scientific Area: Mathematics and Information Science

Institution and Country: NKUA / Greece

Host Institution: NKUA

Collaborating Institution(s): -

Budget: 170.000 euros

Project webpage (if applicable): under construction

Duration: 36 months

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Research Project Synopsis

The objective of the proposal is to support basic research in algebra. We plan to study certain problems that are central in group theory and homological algebra and attract a lot of attention by the experts. These problems are interrelated and have a number of applications. The proposed research will lead to a deeper understanding and advance our knowledge in these areas. The main objectives of this project are:
(i) To study certain invariants that appear in cohomological group theory and analyze their relation to properties of spaces on which the group acts. We plan to examine whether the complete cohomology groups detect (for modules over any ring) the finiteness of classical homological invariants, by exploring duality phenomena.
(ii) To study the information for the structure of a group and its actions on spaces, encoded in Gorenstein projective modules over the group ring. We plan to study the relation between Gorenstein projective and Gorenstein flat modules, the duality between Gorenstein flat and Gorenstein injective modules and examine the existence of Gorenstein projective precovers.
(iii) To study in detail some recent advances in the homological theory of flat modules and explore the applications that these results have in the theory of modules and, in particular, in the theory of modules over group rings. We plan to explicit and clarify constructions that may be performed in the homotopy category of flat modules. As an application, we plan to study the structure of groups of homological dimension one.

Project originality

We use Gorenstein homological algebra and homotopical algebra techniques to study problems dealing with groups and their actions on topological spaces.

Expected results & Research Project Impact

A successful implementation of the project will advance research in group theory and homological algebra. The interested target groups of the project are research teams working in algebra. Since many of the problems under consideration are strongly related to geometry and topology, we expect that the proposed research will have a broad impact on the research communities working in these areas and will be of great interest therein. Some parts of this proposal are closely related to long-standing conjectures in mathematics. The novel aspects of the proposed research formulate an ambitious plan, which is expected to attract the attention of the international research community to the research conducted at NKUA by the research team of the PI and Professor Emerita O. Talelli. This research proposal has also a social impact, as it involves supporting two PhD students, who work towards the completion of their thesis at the University of Athens. It is not certain whether these students would have been able to complete their studies without receiving financial support. In this way, the research project will reinforce the efforts made for Greece's scientific development and promote the competitiveness of NKUA as a center of excellence in research, at the national as well as the international level.

The importance of this funding

The funding of this project gives me the opportunity to develop my research ideas and work with my research associates and my PhD students in that direction.

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COMMUNICATION

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