EUROPEAN CONSORTIUM FOR MATHEMATICS IN INDUSTRY

EU funding: opportunities for mathematicians

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There are several opportunities for EU funding for mathematicians, and perhaps not enough awareness of these opportunities. Some project types are well known (ERC), others are much less known but nevertheless very attractive. Below we list, and briefly explain, some of these opportunities. Most universities have central departments where advice can be obtained on all opportunities mentioned. The description below is based on the present program called H2020, running from 2014-2020.

We also observed that very few mathematicians have become member of an EU review panel. It is good to do so, as it will provide useful insight into the selection process for yourself as well as for your direct colleagues. If you are logged into the participant portal (see link below), you can go to 'my expert area' and register as an expert.

Introduction

The main H2020 grants are to be found in 1 of 3 (so called) pillars, shown here and to be discussed in some detail below. The different pillars can be characterized as Science for Science (Excellent Science), Science for Industry (Industrial Leadership) and Science for Society (Societal Challenges). All relevant information is found on the website https://ec.europa.eu/research/participants/portal/desktop/en/home.html

Excellent Science (24.4 B €)	Industrial Leadership (17 B €)	Societal Challenges (29.7 B €)
European Research Council (13.1 B €)	LEIT = Leadership in enabling and Industrial technologies • ICT • Nano, new materials • Biotechnology • Space (13.5 B €)	Health (7.5 B €)
Future and Emerging Technologies (2.7 B €)		Food (3.9 B €)
Marie Skłodowska-Curie Actions (6.1 B €)	Access to Risk Finance (2.9 B €)	Energy (6 B €)
Research Infrastructures (2.5 B €)	Innovation in SMEs (0.6 B €)	Transport (6.3 B €)
		Climate (3 B €)
		Inclusive Societies (1.3 B €)
		Security (1.7 8 €)

Science for Science (Excellent Science)

The most interesting grants in Excellent Science are (i) ERC grants, (ii) Marie Skłodowska-Curie Actions (in short: Marie Curie or MSCA) and (iii) Future and Emerging Technologies (FET). These grants are all bottom-up and curiosity driven.

ERC grants The individual grants are Starting / Consolidator / Advanced; all supporting top 10 researchers, based on an outstanding cv and an excellent research plan. There are relatively few proposals in mathematics (up till 2016: 3 Starting grant proposals in mathematics). Other interesting ERC Grants are: Proof of concept and Synergy (call 2018). Except for the Synergy Grant, one doesn't need consortia; grants are personal. ERC money can be spent on research costs for yourself as well as for a (small) group.

Marie Sklodowska-Curie Actions fellowships (MSCA)
In particular: Individual fellowships (IF) containing a.o. Standard European Fellowships (EF), Global Fellowships (GF), Career Restart Fellowships. EF's may be of interest e.g. for promoting the career of a young talent by having the opportunity to get experience elsewhere; or by bridging a period in which you can't employ the person. There are special possibilities for re-integration grants, e.g. after maternity leave or after a period outside academia, and programs dedicated to exchange with researchers in industry, and/or for researchers who want to do research outside of academia.

MSCA also finances Innovative Training Networks (ITN), consisting of a.o. European Training Networks (ETN), European Industrial Doctorates (EID) and European Joint Doctorates (EJD); see table 1. These instruments target at Early Stage Researchers and aim to improve the employability of researchers through exposure to organizations in the academic and non-academic sectors, thereby broadening the traditional academic research training setting and eliminating cultural and other barriers to mobility. An essential part of any ITN is therefore the involvement of organizations from different sectors. For EID, the participation of the non-academic sector as a beneficiary is an eligibility criterion. All of these programs are very attractive for mathematicians!

Table 1: Innovative Training Networks (ITN)

Implementation Mode	Country of beneficiaries		Funding for	Leading to doctorate
European Training Networks (ETN)	Minimum: 3 different countries: Member States (MS) or Associated Countries (AC)		3 Y	Not necessarily
European Industrial Doctorates (EID)	EID with 2 beneficiaries	Minimum: 2 different countries: MS or AC	3 Y	Yes
	EID > 2 beneficiaries	Minimum: 2 different countries: MS or AC	3 Y	Yes
European Joint Doctorates (EJD)	Minimum: 3 different countries: MS or AC		3 Y	Yes; at > 1 university

Future and Emerging Technologies (FET)

Future and Emerging Technologies go beyond what is known; this needs visionary thinking. FET has three complementary lines of action: FET Open, FET Proactive and FET Flagships. FET Open is bottom up; it funds projects on new ideas for radically new future technologies, at an early stage when there are few researchers working on a project topic. This can involve a wide range of new technological possibilities, inspired by cutting-edge science, unconventional collaborations of new research and innovation practices. A consortium of at least 3 member states is needed (like for most H2020, non-individual programs). The other two programs are more, or completely, top down.

Science for Industry (Industrial Leadership)

The most interesting calls regarding industrial partnerships can be found in LEIT programs (Leadership in Enabling Industrial Technologies). These programs provide dedicated support for research, development and demonstration and/or for standardization and certification, on information and communications technology (ICT). Emphasis is placed on interactions and convergence across and between the different technologies and their relations to societal challenges. User needs will be taken into account in all these fields.

In short: LEIT is about research and innovation with a strong industrial dimension. The participation of industrial participants is crucial. Still, there are plenty of opportunities for mathematicians in academia, for example on the topics of ICT, Nanotechnologies, Advanced Materials, Manufacturing and Processing and Biotechnology and Space. Calls are top-down and challenges, scope and expected impact are formulated rather precisely. Topics are often split in several sub-themes. Be sure that "your plan" really fits. Work should be done in consortia with typically at least 3 member states. Some calls are dominated by Public-Private Partnerships (Factories of the Future – FOF, High Performance Computing – HPC and Big Data); in these cases industry "made the agenda" and co-finances the program. All calls are top down and at least application oriented. Although surely not exclusively, mathematicians will have a reasonable chance to find opportunities in the ICT program.

Science for Society (Societal Challenges)

This pillar follows a challenge-based approach that brings together resources and knowledge across different fields, technologies and disciplines. This will cover activities from research to market with a new focus on innovation-related activities. In short: also top down and mostly even more application oriented. Some topics: Health, demographic change and wellbeing; Food security; Secure, clean and efficient energy; Smart, green and integrated transport to Europe in a changing world; Secure societies. Mathematics could serve here as enabling technology.

Advice for Mathematicians

- ERC grants are attractive: in FP9, following H2020, the budget will even be increased from 70 bn Euro to 120 bn Euro (7 year period). However, the number of ERC Starting grant applications by mathematicians has been relatively low in recent years. We refer young mathematicians to https://erc.europa.eu/funding/starting-grants. More experienced researchers should not forget to apply for an ERC Consolidator grant: the condition is that you are between 7 and 12 years after receiving your PhD. More info: https://erc.europa.eu/funding/consolidator-grants.

- Mathematicians do take part in MSCA grants, but up to now mainly for ETN type projects. Unfortunately, there are often between 16 and 20 submissions to the MAT panel, and with an overall (for all panels) success rate of 6%, this means that in recent years only the top rated proposal was granted. We advise mathematicians to also look into EID projects, where the PhD students need to spend at least half of their time in industry. PhD students are fully paid by the EID project, no industry contribution needed.

- Within LEIT, there are many interesting topics, such as quantum computing, cryptography, big data, high performance computing, and many different application areas such as energy, ICT, digital twins, materials science etc. Often, there is room for mathematical method development, but of course it requires setting up a network with academic and industry partners from all over Europe.

- In Science for Society, there may also be opportunities for mathematicians, but this is a rather unexplored area so far.