Research PhD position which is a part of the grant NCN SONATA BIS
Nonlinear equations involving the curl-curl operator

It is expected that the PhD student will actively conduct research in the area of nonlinear curl-curl problems, which are motivated by nonlinear Maxwell equations and the Born-Infeld theory. The successful candidate will be a member of the active research team working in the project described below.

The successful candidate will be enrolled in the 4 years PhD program of the Institute of Mathematics of the Polish Academy of Sciences in Warsaw.

Qualifications: Master's degree (or equivalent) in mathematics, physics or computer science. The candidates should demonstrate good knowledge of mathematical analysis, functional analysis and partial differential equations.

Work conditions:

- scholarship contract for 48 months starting from 1 October 2018 (the exact date will be arranged with the sucessful candidate).
- scholarship 3700 PLN per month (tax free).
- health insurance coverage.
- for additional information please contact to the grant director
  dr hab. Jarosław Mederski, prof. IM PAN, email: `jmederski@impan.pl`.

Required application documents:

- CV.
- description of scientific interests.
- description of scientific achievements, awards and distinctions.
- list of publications, talks during conferences and seminars.

The above documents should be sent by **June 15, 2018** to the grant director `jmederski@impan.pl` and cc `anpo@impan.pl`.

Project description: We look for solutions of time-harmonic Maxwell equations in the presence of nonlinear polarization which form models widely investigated in physics and engineering. Nonlinear materials, for instance Kerr-like media, materials with saturation or cubic-quintic effects, play a crucial role in nanotechnology and allow to consider physical structures which are often smaller than the wave length of light. Such nonlinear structures have new and fascinating optical properties that cannot be modelled by using their linear counterparts. The aim of the project is to study time-harmonic electromagnetic waves in nonlinear media by means of variational, bifurcation theories as well as topological methods. The usage of these methods is novel for the nonlinear curl-curl problems and require development of new analytical techniques. We investigate the existence of ground state and bound state solutions of the semilinear Maxwell equations under different nonlinear effects, their multiplicity and symmetric properties. Moreover we investigate curl-curl problems arising in the Born-Infeld theory. From the mathematical point of view, the Euler-Lagrange equations in this theory are very challenging and there is very little work on the problem. Nowadays, the methods of nonlinear analysis seem to be sufficiently strong to provide rigorous analysis of the Born-Infel theory. Our aim is to analyse static solutions as well as vortex solutions. See `www.mat.umk.pl/~mastem`

DYREKTOR
Instytutu Matematycznego PAN

Prof. dr hab. Feliks Przytycki