## $(\mathcal{Q})$ seminář v listopadu a prosinci

O kvantové teorii v různých souvislostech, především pro studenty a doktorandy

Seminář se koná opět presenčně, ale možno jej sledovat i online na adrese uvedené na stránce http://gemma.ujf.cas.cz/~exner/qc.html

### V úterý 1. listopadu ve 14.45 v posluchárně B-111 Andrii Khrabustovskyi: Domains with small resonators and what one can do with them

It is known that attaching to a fix domain  $\Omega$  a small resonator – a set consisting of small set ("room") and a narrow "passage" connecting this room with  $\Omega$  – one can drastically change its spectral properties. Also, domains with such (or similar) resonators are widely used in spectral theory and the theory of Sobolev spaces in order to demonstrate various peculiar effects. In this talk we demonstrate how such domains can be used

- for the construction of an unbounded waveguide-like domain such that the eigenvalues of the Neumann-Dirichlet Laplacian on this domain lying below the essential spectrum threshold coincide with prescribed numbers [1],
- for the construction of a  $\mathbb{Z}^n$ -periodic domain such that the spectral gaps of the Neumann Laplacian on this domain are close to prescribed intervals [2], and
- for the approximation of 1d Schrödinger operators with a  $\delta$ -potential by the Neumann Laplacian on a narrow waveguide-like domain [3].
- G. Cardone, A. Khrabustovskyi: Spectrum of the Laplacian on a domain perturbed by small resonators, arXiv:2203.01971
- [2] A. Khrabustovskyi, E. Khruslov, work in progress
- [3] A. Khrabustovskyi, O. Post: A geometric approximation of  $\delta$ -interactions by Neumann Laplacians, J. Phys. A: Math. Theor. 54 (2021), 465201

#### V úterý 29. listopadu ve 14.45 v posluchárně B-111

# Sylwia Kondej (University of Zielona Gora): Quantum system with concentric circles and Aharonov–Bohm flux

In this talk we discuss a class of two-dimensional Schrödinger operator with a singular interaction of the  $\delta$  type and a fixed strength supported by an infinite family of concentric, equidistantly spaced circles. We analyze what happens below the essential spectrum after implementing an Aharonov-Bohm flux  $\alpha \in [0, 1/2]$  in the center. We prove that there exists a critical value  $\alpha_{\rm cr} \in (0, 1/2)$  such that the discrete spectrum has an accumulation point when  $\alpha < \alpha_{\rm cr}$ , while for  $\alpha \geq \alpha_{\rm crit}$  the number of eigenvalues is finite. The talk is based on a common work with P. Exner.

#### V úterý 6. prosince ve 14.45 v posluchárně B-111

### **Davron Matrasulov** (Turin Polytechnic University Tashkent): **Dynamical confinement in low-dimensional quantum systems: Recent achievements and open problems**

In this talk, I will discuss the problem of dynamical quantum confinement, described in terms of Schrödinger and Dirac equations with time-dependent boundary conditions. Practical applications in quantum optics, atom optics and condensed matter physics will be discussed. Open problems, to be atatcked from mathematicsal viewpoint will be also presented.

V úterý 13. prosince ve 14.45 v posluchárně B-111

# Olena Atlasiuk (MÚ AV ČR): Linear ordinary differential systems with generic boundary conditions in Sobolev spaces

We study linear systems of ordinary differential equations on a finite interval with the most general (generic) inhomogeneous boundary conditions in Sobolev spaces. These boundary problems include all known types of classical and numerous nonclassical conditions. The latter may contain derivatives of integer and fractional order, which may exceed the order of the differential equation. We investigate the characteristic of solvability of inhomogeneous boundary-value problems, prove their Fredholm properties, and find the indices, the dimensions of the kernel, and the cokernel of these problems. Moreover, we obtained the necessary and sufficient conditions for continuity in the parameter of solutions to the introduced boundary-value problems in the Sobolev spaces. Some applications of these results to the solutions of multipoint boundary-value problems are also presented.

The talk is based on joint work with Professor Volodymyr Mikhailets.

Semináře probíhají střídavě

- **[B]** v budově FJFI ČVUT, Břehová 7, Praha 1
- **[T]** na katedře matematiky FJFI ČVUT,

 $[\mathbf{\check{R}}]$  v oddělení teoretické fyziky ÚJF AV ČR, Řež u Prahy

[HK] v oddělení matematické fyziky KF University Hradec Králové, budova 5, Víta Nejedlého 573

Podrobnější popis, jak se dostat na některé z uvedených míst, zašlou organizátoři na požádání.

Informace o další programu budou zasílány průběžně a vyvěšovány na http://www.ujf.cas.cz/~exner/qc.html

> Pavel Exner Miloslav Havlíček