EDITORS' PREFACE TO THE TOPICAL ISSUE: "SPECTRAL THEORY AND APPLICATIONS TO MATHEMATICAL PHYSICS"

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Since the beginning of the twentieth century, Spectral Theory has been the subject of constant development and has found more and more applications. Apart from its own richness and from giving rise to a variety of new mathematical concepts, Spectral Theory is a pillar of various branches of Mathematics such as: Partial Differential Equations, Functional Analysis, Operator Algebras, and Non-commutative Geometry. In Physics, no doubt about it, one of the most striking successes of Spectral Theory has been the development of Quantum Mechanics and Quantum Field theory, two subjects whose formalisms and methods are built on this theory. Spectral theory plays an important role in many other applications of Partial Differential Equations, such as the method of layer potentials.

The interest in Spectral Theory has not faded over the years. Recently, the spectral analysis of operators arising from Quantum Mechanics and Quantum Field Theory has attracted a lot of attention in the Mathematical Physics community. In particular, the following directions of research connected to Spectral Theory have recently been studied, as illustrated, in particular, by the papers in this topical issue:

- The structure of the spectrum of Quantum Hamiltonians [4, 14, 15].
- Quantum Field Theory on curved space times and quantization in infinite dimensional settings [8, 9, 13].
- Spectral theory on graphs and the study of quantum walks [6].
- Magnetic hamiltonians and algebraic methods [7, 11, 15].
- The location of the essential spectrum and the absence of embedded eigenvalues or of the singular continuous spectrum [5, 12, 16, 18].
- The analysis of partial differential operators on singular or non-compact spaces [1, 2] (the spectral theory of partial differential operators and the

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localization of the eigenfunctions in domains with corners has been especially active) [3, 10, 17].

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REFERENCES

[1] B. Ammann, N. Große and V. Nistor, *The strong Legendre condition and the well-posedness of mixed Robin problems on manifolds with bounded geometry.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 85-111.

[2] C. Carvalho, R. Côme and Yu Qiao, *Gluing action groupoids: Fredholm conditions and layer potentials.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*,113–156.

[3] M. Dauge, Y. Lafranche and T. Ourmières-Bonafos, *Dirichlet spectrum of the Fichera layer.* Integral Equations Operator Theory **90** (2018), *5*, Art. 60, 41.

[4] J. Faupin and J. Fröhlich, *Asymptotic completeness in dissipative scattering theory.* Adv. Math. **340** (2018), 300–362.

[5] J. Faupin, J.S. Møller and E. Skibsted, *Second order perturbation theory for embedded eigenvalues.* Comm. Math. Phys. **306** (2011), *1*, 193–228.

[6] T. Fuda, D. Funakawa and A. Suzuki, *Weak limit theorem for a one-dimensional split-step quantum walk.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 157–165.

[7] V. Georgescu and A. Iftimovici, *Crossed products of C^*-algebras and spectral analysis of quantum Hamiltonians.* Comm. Math. Phys. **228** (2002), *3*, 519–560.

[8] C. Gérard, *On the Hartle-Hawking-Israel states for spacetimes with static bifurcate Killing horizons.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 167–195.

[9] C. Gérard and M. Wrochna, *Analytic Hadamard States, Calderón Projectors and Wick Rotation Near Analytic Cauchy Surfaces.* Comm. Math. Phys. **366** (2019), *1*, 29–65.

[10] B. Helffer and K. Pankrashkin, *Tunneling between corners for Robin Laplacians.* J. Lond. Math. Soc. (2) **91** (2015), *1*, 225–248.

[11] V. Iftimie, M. Măntoiu and R. Purice, *Quantum observables as magnetic* ΨDO. Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 197–223.

[12] I. Inoue and S. Richard, *Topological Levinson's theorem for inverse square potentials: complex, infinite, but not exceptional.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 225–250.

[13] L. Jager, *Pseudodifferential operators in infinite dimensional spaces: a survey of recent results.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 251–282.

[14] T. Jecko, *On Schrödinger and Dirac operators with an oscillating potential.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 283–314.

[15] P. Miranda and N. Popoff, *Band functions of Iwatsuka models: power-like and flat magnetic fields.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 315–324.

[16] J. Mougel, *Essential spectrum, quasi-orbits and compactifications: application to the Heisenberg group.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 325–343.

[17] K. Pankrashkin, *On self-adjoint realizations of sign-indefinite Laplacians.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 345–372.

[18] O. Post and J. Simmer, *Quasi-unitary equivalence and generalised norm resolvent convergence.* Rev. Roumaine Math. Pures Appl. **64** (2019), *2–3*, 373–391.

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