Winter Semester 2025/26

S5B5 – Graduate Seminar on Advanced Topics in Functional Analysis & Operator Theory

Random operators and resonances

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Seminar is on **Tuesdays 10:00-12:00, room: N0.008 (Neubau).**

List of Topics.

No.	Date	Title of the topic and short description	Speaker
1	28.10.2025	**Spectra of conservative systems modeled by random Schrödinger operators. Continuation resonances in open systems.** Introduction, basic definitions and theorems, and the applied motivation [DZ, K16].	I. Karabash
2	11.11.2025	**Random discrete Schrödinger operators of the Anderson model and their deterministic spectra.** [K, Sections 3.1 and 3.4]	T.M.
3	18.11.2025	**Ergodic stochastic processes. Ergodic operators.** [K, Sections 4.1 and 4.2]	L.L.
4	25.11.2025	**Measurability of general random operators. Projections to absolutely continuous and pure point spectra.** [KM82, Sections 1.1, 2.1, and 2.3] and [RS1, Theorem VII.4] with the definitions of pure point, absolutely continuous, and singular spectra.	P.A.
5	02.12.2025	**The density of states.** [K, Section 5.1].	T.B.
6	09.12.2025	**Discrete boundary conditions and the alternative approach to the density of states.** [K, Sections 5.2 and 5.4]	N.M.
7	16.12.2025	**The Lyapunov exponent.** [CFKS, Section 9.3] (see also [PF, Chapter 5]).	Davide Macera
8	20.01.2026	**Continuation resonances and spectra of stochastic stuctures in Mathematics and Photonics.** [DZ, Sections 2.1-2.3],[D$^+$14]	I. Karabash
9	27.01.2026	**Minami estimate and Poisson point processes.** [AW, CGK10]	Davide Macera
10	03.02.2022	**Asymptotics of random resonances for the 1-d Anderson model with cut-off potentials.** [K16, Section 1C]	I. Karabash

Literature

[AW] Aizenman, M. and Warzel, S., 2015. Random operators (Vol. 168). American Mathematical Soc..

[CGK10] Combes, J.M., Germinet, F. and Klein, A., 2010. Poisson statistics for eigenvalues of continuum random Schrödinger operators. Analysis & PDE, 3(1), pp.49-80.

[CFKS] Cycon, H.L., Froese, R.G., Kirsch, W. and Simon, B., 1987. Schrödinger operators with applications to quantum mechanics and global geometry, Springer.

[D+14] Dharanipathy, U.P., Minkov, M., Tonin, M., Savona, V., and Houdré, R., 2014. High-Q silicon photonic crystal cavity for enhanced optical nonlinearities, Appl. Phys. Lett. 105(10), 101101.

[DZ] Dyatlov, S. and Zworski, M., 2019. Mathematical theory of scattering resonances. AMS (see also https://math.mit.edu/ dyatlov/res/res_final.pdf).

[K] Kirsch, W., 2008. An invitation to random Schrödinger operators. With an appendix by F. Klopp. In: Random Schrödinger operators, pp. 1–119, Soc. Math. France, Paris, see also the arXiv preprint arXiv:0709.3707; https://doi.org/10.48550/arXiv.0709.3707

[KM82] Kirsch, W. and Martinelli, F., 1982. On the ergodic properties of the specrum of general random operators. Journal für die reine und angewandte Mathematik, 334, pp.141-156.

[K16] Klopp, F., 2016. Resonances for large one-dimensional "ergodic" systems, Analysis & PDE 9(2), 259–352. http://dx.doi.org/10.2140/apde.2016.9.259

[PF] Pastur, L.A. and Figotin, A., 1992. Spectra of random and almost-periodic operators. Berlin: Springer.

[RS1] Reed, M. and Simon, B., Methods of modern mathematical physics I: Functional analysis. Academic press. 1972 (many copies available in the library).