

Curriculum Vitae

Personal Information

Name Gamal Mograby
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Research Interests

Mathematical physics on fractals and graphs; Quantum computing and information theory; Spectral theory on weakly self-similar systems and quasicrystals; Random Schrödinger Operators.

Education & Employment

- Sep 2022 – present **Postdoctoral Associate** *Tufts University, USA*
Mentors: Kasso Okoudjou, Sasha Teplyaev, Radhakrishnan Balu.
- Sep 2020 – June 2022 **Postdoctoral Associate** *University of Maryland, USA*
Mentors: Kasso Okoudjou, Sasha Teplyaev, Radhakrishnan Balu.
- Aug 2016 – Aug 2020 **Ph.D. in Mathematics** *University of Connecticut, USA*
Thesis: Quantum Information on Fractals and Graphs.
Advisors: Sasha Teplyaev, Gerald Dunne, Luke Rogers.
- Oct 2010 – Jul 2016 **Diplom in Physics** *Berlin Institute of Technology, Germany*
Thesis: Statistics of the Power Transmission Coefficient in Different Dimensions. Advisors: Arkady Pikovsky, Tobias Brandes.
- Jun 2013 – Aug 2013 **Research Project** *Cornell University, USA*
Anderson Localization on the Sierpinski Gasket.
Advisor: Robert Strichartz.
- Apr 2004 – Sep 2010 **Diplom in Mathematics** *Berlin Institute of Technology, Germany*
Thesis: Application of Fractional Differentiation to Fractal Geometry.
Advisors: Wolfgang Schief, Yury Luchko.

Note: German Diplom degree is a five-year program equivalent to having earned both bachelor's and master's degrees.

Publications & preprints

2022

- *Spectral decimation of a self-similar version of almost Mathieu-type operators*, G. Mograby, R. Balu, K. Okoudjou, A. Teplyaev, *Journal of Mathematical Physics* 63, 053501 (2022). DOI: [10.1063/5.0078939](https://doi.org/10.1063/5.0078939)
- *Quantitative approach to Grover's quantum walk on graphs*, G. Mograby, R. Balu, K. Okoudjou, A. Teplyaev, 2022 (submitted). [arXiv : 2207.01686](https://arxiv.org/abs/2207.01686)
- *Gaps labeling theorem for the Bubble-diamond self-similar graphs*, E. Melville, G. Mograby, N. Nagabandi, L. Rogers and A. Teplyaev, 2022 (submitted). [arXiv : 2204.11401](https://arxiv.org/abs/2204.11401)
- *Spectral decimation of piecewise centrosymmetric Jacobi operators on graphs*, G. Mograby, R. Balu, K. Okoudjou, A. Teplyaev, 2022 (submitted). [arXiv : 2201.05693](https://arxiv.org/abs/2201.05693)

2021

- *Hamiltonian systems, Toda lattices, solitons, Lax pairs on weighted \mathbb{Z} -graded graphs*, G. Mograby, M. Derevyagin, G. Dunne and A. Teplyaev, *Journal of Mathematical Physics* 62, 042204 (2021). DOI: [10.1063/5.0025475](https://doi.org/10.1063/5.0025475)
- *Spectra of perfect state transfer Hamiltonians on fractal-like graphs*, G. Mograby, M. Derevyagin, G. Dunne and A. Teplyaev, *Journal of Physics A: Mathematical and Theoretical* 54(12), 125301 (2021). DOI: [10.1088/1751-8121/abc4b9](https://doi.org/10.1088/1751-8121/abc4b9).
- *Discretization of the Koch Snowflake Domain with Boundary and Interior Energies*, M. Gabbard, C. Lima, G. Mograby, L. Rogers, A. Teplyaev. In "Fractals in Engineering: Theoretical Aspects and Numerical Approximations", M. Lancia and A. Rozanova-Pierrat, Springer International Publishing, pp. 79–102 (2021). DOI: [10.1007/978-3-030-61803-2](https://doi.org/10.1007/978-3-030-61803-2).
- *Spectra of three-peg Hanoi towers graphs*, B. Hungar, G. Mograby, M. Phelps, L. Rogers and J. Wheeler, 2021 (submitted). [arXiv : 2107.02697](https://arxiv.org/abs/2107.02697)

2020

- *Perfect quantum state transfer on diamond fractal graphs*, M. Derevyagin, G. Mograby, G. Dunne and A. Teplyaev, *Quantum Information Processing* 19, 328 (2020). DOI: [10.1007/s11128-020-02828-w](https://doi.org/10.1007/s11128-020-02828-w).
- *Harmonic Gradients on Higher Dimensional Sierpinski Gaskets*, L. Brown, G. Ferrer, G. Mograby, L. Rogers and K. Sangam. *Fractals* 28(6), 2050108 (2020), DOI: [10.1142/S0218348X2050108X](https://doi.org/10.1142/S0218348X2050108X).

Conferences, Workshops & Talks

- Nov 2022 **(Invited talk) Mathematical Physics and Harmonic Analysis Seminar** *Texas A&M, USA (Talk title "TBA")*.
- Jul 2022 **(Invited talk) IBM/Tufts Quantum Computing Workshop** *Tufts University, USA (Talk title "Quantum walks on graphs")*.
- Jul 2022 **Qiskit Global Summer School 2022 on Quantum Simulations** *hosted by IBM Quantum*.
- Jun 2022 **(Invited talk) 7th Cornell Conference on Analysis, Probability, and Mathematical Physics on Fractals** *Cornell University, USA (Talk title "Gaps labeling theorem for Diamond self-similar graphs")*.
- Mar 2022 **(Invited talk) Quantum Computing Workshop** *Uconn SIAM Student Chapter (Talk title "Graphs in quantum information theory")*.
- Mar 2022 **(Invited talk) Spring Eastern Sectional Meeting "special session on quantum probability, orthogonal polynomials, and special functions"** *formerly at Tufts University (Talk title "Classical and quantum mechanical models on graphs")*.
- May 2021 **Workshop "Quasi-periodic spectral and topological analysis"** *University of Connecticut & Tufts University, USA*.
- May 2018 **Workshop "Transport and localization in random media: theory and applications"** *Columbia University, USA*.
- Jun 2017 **6th Cornell Conference on Analysis, Probability, and Mathematical Physics on Fractals** *Cornell University, USA*.
- Mar 2015 **Winter School on Diffusion on Fractals and Non-linear Dynamics** *University of Bremen, Germany*.
- Jun 2014 **(Invited talk) 5th Cornell Conference on Analysis, Probability, and Mathematical Physics on Fractals** *Cornell University, USA (Talk title "Anderson localization on the Sierpinski triangle")*.

Awards

- UCONN Research Excellence Program Award 2019 "Perfect and near perfect quantum state transfer and inverse spectral problems on graphs" (\$ 16,731 Research Assistantship)

- o Cornell Support Award, June 2014. (\$ 1,797).

Mentoring Undergraduate Researchers

REU mentor at Tufts University, USA

- 2022 Summer Semester.

REU mentor at the University of Connecticut, USA

- 2019 Summer Semester.
- 2018 Summer Semester.
- 2017 Summer Semester.

Teaching Experience

Aug 2022 – May 2023 *Instructor/TA at Tufts University, USA*

- 2022 Fall Semester: Calculus I.

Aug 2016 – May 2020 *Instructor/TA at University of Connecticut, USA*

- 2020 Spring Semester: Calculus II.
- 2019 Spring Semester: Applied Linear Algebra.
- 2018 Fall Semester: Calculus III.
- 2018 Spring Semester: Calculus II.
- 2017 Fall Semester: Calculus I.
- 2017 Spring Semester: Calculus I.
- 2016 Fall Semester: Calculus I.

Oct 2010 – Mar 2012 *Instructor/TA at the Free University of Berlin, Germany*

- 2010/11 Winter Semester : Mathematics for Physicists III.
- 2011 Summer Semester : Mathematics for Physicists II.
- 2010/11 Winter Semester : Mathematics for Physicists III.

Services & outreach

Sep 2021 - present **Co-organizer of "Analysis Seminar"** *Tufts University, USA.*

Sep 2021 - present **Co-organizer of "Quantum Computing Reading Group"** *Tufts University, USA.*

Summer 2019 **Co-organizer of "Sigma Seminar"** *University of Connecticut, USA.*

Jan 2018 - Oct 2018 **Co-organizer of "Mathematical Physics Seminar"** *University of Connecticut, USA.*

Aug 2017 **Co-organizer of "5th Northeast Mathematics Undergraduate Research Mini-Symposium"** *University of Connecticut, USA.*

IT-Skills

Python, Java, Matlab, Mathematica.

Languages

German, English