

# Dr. Peter Zalom

Theoretical physicist specializing in quantum technologies, working on the edge between analytic and numeric methods. Expert in various renormalization group techniques with strong background in (quantum) field theories, Green's functions, Kondo physics and superconductivity. Until 2018, research conducted on fully developed classical turbulence in soft matter, afterwards successful transition into the condensed matter physics. Currently working on quantum-dot-based multi-terminal Josephson junctions and short chains of quantum dots using "log-gap" Numerical Renormalization group (NRG) method that I developed. Teaching experience covers students up to PhD level.



Position: Researcher at FZU - Institute of Physics of the Czech Academy of Sciences,  
Na Slovance 1999/2, 182 00 Prague 8, Czechia  
Born: 28. 4. 1985 in Poprad, Slovakia  
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## Research impact

- 7 papers in Physical Review B and 1 in J. Phys. Chem C. since 2019
- recent paper in Physical Review Letters
- tripling of citations in last three years (from 14 to 48)
- reviewer for PRB, PRL, Physics Letters A, Scientific Reports

## Achievements

- development of "log-gap" NRG for strongly-correlated systems with arbitrary spectral gaps
- successful transition from soft to condensed matter
- Young Scientist Award at IEP of the Slovak Academy of Sciences

## Active research grants

- DAAD Grant, Co-PI with UNI Konstanz (2025-2026)
- GACR Standard Grant, Key Investigator (2023-2025)

## Active international collaborations

- Prof. Ireneusz Weymann, AMU Poznań (Poland)
- Prof. Wolfgang Belzig, University of Konstanz (Germany)+
- Dr. Alessandro Braggio, CNR Istituto Nanoscienze (Italy)
- Prof. Rok Žitko, Jožef Stefan Institute in Ljubljana (Slovenia)

## Work & Education

Dates & position held	<b>2024 – present, research fellow</b>
Main activities and responsibilities:	NRG and effective models for superconducting devices
Name and address of employer:	FZU - Institute of Physics of the Czech Academy of Sciences, Na Slovance 1999/2, 182 00 Prague 8, Czechia
Dates & position held	<b>2017 – 2023, post-doc</b>
Main activities and responsibilities:	Two-particle self-consistency in Kondo physics, NRG techniques for normal and superconducting environments
Name and address of employer:	FZU - Institute of Physics of the Czech Academy of Sciences, Na Slovance 1999/2, 182 00 Prague 8, Czechia
Dates & position held	<b>2016 – 2017, post-doc</b>
Main activities and responsibilities:	Independent research of fully developed turbulence in soft matter
Name and address of employer:	Bogoliubov Laboratory of Theoretical Physics, 141980 Dubna, Moscow region, Russia
Dates & position held	<b>2011 – 2015, PhD student</b>
Name and address of the organization:	Institute of Experimental Physics of the Academy of Sciences of the Slovak Republic, Watsonova 47, Košice 147 00, Slovakia
Qualification work:	Field-theoretical models of fully developed turbulence
Dates & position held	<b>2008 – 2011, master student in biophysics</b>
Name and type of organization:	Charles University in Prague Ke Karlovu 3, 121 16 Praha 2, Czech Republic
Qualification work:	Regulation of intracellular pH in yeast - influence of selected transport proteins
Dates & position held	<b>2004 – 2008, bachelor student in general physics</b>
Name and type of organization:	Charles University in Prague Ke Karlovu 3, 121 16 Praha 2, Czech Republic
Qualification work:	A Measurement of Spin of Higgs Boson

### **Awards and achievements**

2025	DAAD grant awarded (4 out of 80 supported) in the role of Co-PI on the problem of multi-terminal Josephson junctions with Prof. Wolfgang Belzig.
2018-2024	Transition into the field of superconducting quantum devices, within six years established as an recognized researcher with independent contributions
2014	Edufyce travel grant awarded
2013	Awarded 1st place in the Young Scientist competition (under 35) at Slovak Academy of Sciences, Institute of Experimental Physics, Košice
2005	Study scholarship at the Charles University in Prague

### **Teaching**

2024 – present	Computational condensed matter theory - creating and teaching the course (3 hours per semester) - leading related student projects
2024 – 2025	Supervision of advanced research project of a master student: - supercurrent transistor/diode effect in multi-terminal Josephson junctions - 2 PRB articles in preparation - direct application of the analytic method from my PRL publication
2012	Exercises for Thermodynamics and Statistical physics, - undergraduate level 3+3 hours per week (80 hours a semester) - teaching and scientific specializations separated classes
2005 – 2011	Individual lecturer on Physics, Mathematics, German and English languages. 5-6 students a semester.
Teaching philosophy:	I lay emphasis on guiding students towards independent thinking and creativity by highlighting possible applications beyond the pure elements of teaching.

### **Skills and competences**

Programming:	C++ advanced Python intermediate
Scripting:	Bash advanced Perl intermediate
Scientific software:	Mathematica advanced NRG Ljubljana advanced DM-NRG Budapest advanced
Scientific methods:	Renormalization group methods (field theoretical, FRG, NRG) effective models of superconducting heterostructures (atomic limit and its generalized version, zero-band-width model) parquet equations Green's functions (quantum) field theories
Mathematical tools:	Statistical and mathematical analysis, numerical methods

<b>Languages</b>	
Mother tongues:	Slovak, Czech
Other Languages:	German -learned at German bilingual school in Poprad, Slovakia during the year 2000 -German High school diploma obtained in 2004 -listening, reading, spoken interaction and production, writing at C1 level (proficient user)
	English -learned via active usage during University studies -listening, reading, spoken interaction and production, writing at C1 level (proficient user)
	Polish -learning via self studying methods -listening, reading, spoken interaction & production, writing at approximately B1 level (intermediate user)

In Prague, Czech republic 19<sup>th</sup> of January 2025

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