

CURRICULUM VITAE

PERSONAL INFORMATION

Date and place of birth	1981, Poland
Nationality	Polish
Correspondence address	Poland
Phone number	
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ORCID	0000-0002-9769-7646

EMPLOYMENT

- Institute of Physical Chemistry of Polish Academy of Sciences (since 2015), assistant professor (Polish: adiunkt)

EDUCATION

- 2005 – 2011: Ph.D. studies, Faculty of Physics, University of Warsaw, thesis titled „Hydrodynamic function and transport coefficients for suspensions of spherical particles” supervised by prof. dr hab. Bogdan Cichocki
- 2000 – 2005: master studies in Physics in the field of theoretical physics, Faculty of Physics, University of Warsaw, master thesis titled „Effective propagator for systems with induced sources of interparticle interactions” supervised by prof. dr hab. Bogdan Cichocki

SCIENTIFIC EXPERIENCE

- since 01.12.2015: assistance professor at the Institute of Physical Chemistry of Polish Academy of Sciences, Warsaw
- 03.2019 – 03.2020 visiting associate at the California Institute of Technology (work with Dr. John Brady funded by the Polish National Agency for Academic Exchange)
- 01.01.2017 - 30.04.2017: postdoc at the California Institute of Technology (work with Dr. John Brady funded by the Kosciuszko Foundation)
- 10.06.2013 - 09.12.2016: grant holder, Faculty of Physics, University of Warsaw
- 01.10.2011 - 30.06.2015: postdoctoral position in TEAM project (project leader: dr hab., Krzysztof Byczuk, prof. of University of Warsaw), Faculty of Physics, University of Warsaw

LIST OF SCIENTIFIC PUBLICATIONS

1. Ott Scheler, Karol Makuch, Pawel R Debski, Michal Horka, Artur Ruszczak, Natalia Pacocha, Krzysztof Sozanski, Olli-Pekka Smolander, Witold Postek, Piotr Garstecki
"Droplet-based digital antibiotic susceptibility screen reveals single-cell clonal heteroresistance in an isogenic bacterial population"
Scientific Reports (2020) 10:3282
2. Karol Makuch, Robert Holyst, Tomasz Kalwarczyk, Piotr Garstecki, John F. Brady
"Diffusion and flow in complex liquids"
Soft Matter, 2020, 16, 114
3. Yu-Ting Kao, Tomasz S. Kaminski, Witold Postek, Jan Guzowski, Karol Makuch, Felix von Stetten, Roland Zengerle, and Piotr Garstecki
"Gravity-driven microfluidic assay for digital enumeration of bacteria and for antibiotic susceptibility testing"
Lab Chip, 2020, 20, 54
4. B. Chatterjee, J. Skolimowski, K. Makuch, and K. Byczuk
"Real-space dynamical mean-field theory of Friedel oscillations in strongly correlated electron systems"
Phys. Rev. B 100, 115118 (2019)
5. Karol Makuch, Jean Baptiste-Gorce, Piotr Garstecki
"Non-wetting droplets in capillaries of circular cross-section: scaling function"
Physics of Fluids 31, 043102 (2019)
6. Adam S. Opalski, Karol Makuch, Yu-Kai Lai, Ladislav Derzsi and Piotr Garstecki
"Grooved step emulsification systems optimize throughput of passive generation of monodisperse emulsions"
Lab Chip, 2019, 19, 1183-1192
7. Magdalena A. Czekalska, Tomasz S. Kaminski, Karol Makuch, and Piotr Garstecki
"Passive and parallel microfluidic formation of droplet interface bilayers (DIBs) for measurement of leakage of small molecules through artificial phospholipid membranes"
Sensors and Actuators B: Chemical Volume 286, 1 May 2019, Pages 258-265
8. K. Makuch
"Generalization of Clausius-Mossotti approximation in application to short-time transport properties of suspensions"
Phys. Rev. E **92**, 042317 (2015)
9. K. Makuch, Przemysław Górka
Multipole matrix elements of Green function of Laplace equation
Acta Physica Polonica, B 46, 1487 (2015)
10. K. Makuch, Marco Heinen, Gustavo C. Abade, Gerhard Nägele
Rotational self-diffusion in suspensions of charged particles: Revised Beenakker-Mazur and Pairwise Additivity methods versus numerical simulations
Soft Matter, 2015, **11**, 5313 - 5326
11. K. Makuch, J. Skolimowski, P.B. Chakraborty, K. Byczuk, D. Vollhardt,
Thermodynamic properties of correlated fermions in lattices with spin-dependent disorder
New J. Phys. 15, 045031 (2013)
12. K. Makuch, B. Cichocki,
Transport properties of suspensions - critical assessment of Beenakker-Mazur method,

- J. Chem. Phys. 137 184902 (2012)
13. K. Makuch,
Scattering series in mobility problem for suspensions,
J. Stat. Mech.: Theory Exp. 2012, P11016

PATENTS PENDING

1. A. Opalski, K. Makuch., Yu-Kai Lai, P. Garstecki
"Microfluidic chip for production of monodisperse emulsions"
Application number P.425543 (2018)

GRANTS AND FELLOWSHIPS

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| 2018 | Fellowship of the Polish National Agency For Academic Exchange for one year research at the California Institute of Technology, "Active matter inside droplet", 185000 PLN |
| 2017-2020 | Grant holder and principal researcher in „Properties of complex liquids and their microscopic structure” grant „SONATA 11” founded by National Science Center, Poland, three-year project, funds: 492 600 PLN |
| 2016 | Fellowship of the Kosciuszko Foundation for 4 month research at the California Institute of Technology, 12000 USD |
| 2015-2016 | Researcher in “"Microfluidic Combinatorial On Demand Systems: a Platform for High-Throughput Screening in Chemistry and Biotechnology" ERC Starting grant, five-year project, funds :1,75 mln EUR |
| 2013-2015 | Grant holder and principal researcher in „Macroscopic properties of dispersive media”, grant founded by Polish Ministry of Science and Higher Education in frame of program „Iuventus Plus”, two-year project, funds: 154 100 PLN |
| 2011-2015 | Researcher in “Predictive multi-scale simulations for correlated particles inside complex environments” led by dr hab. Krzysztof Byczuk, prof UW, funded by Foundation for Polish Science, four-year project, funds: 2 175 000 PLN |

AWARDS

- 2011: Ph.D degree cum laude
- 2009: Scholarship “Mazovian Ph.D. Scholarship”
- 2005: M.Sc. degree cum laude
- 2001-2005: Scholarship in Faculty of Physics, University of Warsaw (since the second year of studies)

CONFERENCE TALKS

- 2019: "Stokes' law in complex liquids and inside cell cytoplasm"
72nd Annual Meeting of the American Physical Society's Division of Fluid Dynamics, November 23-26, 2019, Seattle, USA

- 2019: "Stokes' law in complex liquids and inside cell cytoplasm"
Cell Physics 2019, 9-11.10.2019, Saarbrücken, Germany
- 2018: "Stokes' law in complex liquids and inside cell cytoplasm"
7th European Conference on Computational Fluid Dynamics, Glasgow, Scotland, 11-15.06.2018
- 2017: "Do bubbles screen?"
So Cal Fluids XI, San Diego, USA, 22.04.2017
- 2015: "Metal - Mott insulator heterostructures: real space dynamical mean-field study"
Deutsche Physikalische Gesellschaft Spring Meeting, Berlin 16-20.03.2015
- 2014: "Thermodynamics of simple cubic Hubbard model – dynamical mean-field study"
From Spins to Cooper Pairs, 650th Jubilee of the Jagiellonian University, 22-26.09.2014, Zakopane, Poland
- 2013: „Correlated lattice fermions in a spin-dependent random potential”
Deutsche Physikalische Gesellschaft Spring Meeting, Regensburg 10.03.2013-15.03.2013

POSTER PRESENTATIONS

- "Stokes' law in complex liquids"
Frontiers in Physical Chemistry Symposium Caltech, Pasadena, USA, 16-17.02.2017
- "Stokes law in complex liquids"
„6th Warsaw School of Statistical Physics”, Sandomierz, Poland, 25.06-02.07.2016
- "Transport coefficients of suspensions of spherical particles"
Nonequilibrium collective dynamics, Potsdam, Germany, 5-8.10.2015
- "Metal - Mott insulator heterostructures: A dynamical mean field study"
Correlated Electron Systems, GRC, South Hadley, USA, 22-27.06.2014,
- "Transport coefficients for suspensions of spherical particles"
Colloidal, Macromolecular & Polyelectrolyte Solutions, GRC, Ventura, USA, 16-21.02.2014
- "Transport coefficients for suspensions of spherical particles"
„5th Warsaw School of Statistical Physics”, Kazimierz Dolny, Poland,
STATPHYS25, 22-26.07.2013, Seoul, Republic of Korea
- "Correlated lattice fermions in a spin-dependent random potential"
„*The New Generation in Strongly Correlated Electron Systems*” 2013, Sestri Levante, Italy, 1–5.07.2013
- „Approximate method of calculation of transport coefficients for suspensions”
„2nd Warsaw School of Statistical Physics”, Kazimierz Dolny, Poland, 15.06.2007-22.06.2007

SELECTED SEMINAR TALKS (OVERALL MORE THAN 30)

1. "Speed of flow of non-wetting droplets in capillaries of circular cross-section – theory"
Institute of Physical Chemistry, Polish Academy of Sciences, 15.03.2018
2. "Stokes' law in complex liquids"
California Institute of Technology, Department of Chemical Engineering, USA, 13.02.2018
3. "Homogenization theory in complex liquids"
Simons Foundation, Flatiron Institute, New York, USA, 05.07.2017
4. "Short-time transport properties of suspensions of spherical particles”, University of Konstanz,
Physics Department, Germany, 22.10.2015

5. "Transport properties of colloidal suspensions", Princeton University, Department of Chemistry, USA, 26.03.2015
6. "Beenakker-Mazur expansion for suspensions of repulsive particles", California Institute of Technology, Department of Chemical Engineering, USA, 25.02.2015
7. "Rotational self-diffusion in suspensions of repulsive particles" University of Warsaw, Faculty of Physics, Poland, 05.12.2014
8. "Transport coefficients for suspension of spherical particles" Warsaw University of Technology, Department of Mathematics and Information Sciences, Poland, 15.05.2014
9. "Thermodynamic properties of correlated fermions in lattices with spin-dependent disorder" Maria Curie-Skłodowska University, Institute of Physics, Lublin, Poland, 01.04.2014
10. "Structure and transport coefficients of charged and neutral colloidal particles" California Institute of Technology, Department of Chemical Engineering, USA, 13.02.2014
11. "Macroscopic properties of suspensions of spherical particles" Forschungszentrum Julich, Germany, 13.11.2013
12. "Tunnelling current through insulating barrier" University of Warsaw, Faculty of Physics, Poland, 18.06.2013
13. „Thermodynamic properties of correlated fermion in lattices with spin-dependent disorder” University of Warsaw, Faculty of Physics, Poland, 21.03.2013
14. „Hydrodynamic function and effective transport coefficients for suspension of spherical particles” Polish Academy of Sciences, Institute of Fundamental Technological Research, Poland, 21.12.2011
15. „Dynamical mean field theory" University of Warsaw, Faculty of Physics, Poland, 15.12.2011

RESEARCH VISITS

- 18.02-02.03.2018 Work with Dr. Marco Heinen on scattering of light in suspensions, University of Guanajuato, Mexico
- 29.05-02.06.2017 Work with dr hab. Anna Maciołek on diffusion of dimers in complex liquids, Max Planck Institute for Intelligent Systems, Stuttgart, Germany
- 19-23.10.2015 Work with Dr. Gustavo Coelho Abade on transport properties of suspensions, University of Konstanz, Germany
- 23-27.03.2015 Work with Dr. Marco Heinen on transport properties of suspensions of charged particles, California Institute of Technology, USA
- 12-15.11.2013 Work with prof. Gerhard Naegele and Dr. Marco Heinen on transport properties of suspensions of charged particles, Forschungszentrum Julich, Germany

LECTURES AND TEACHING EXPERIENCE

22,27.03.2018 University of Guanajuato "Hydrodynamics in Soft Matter" (4h)

Tutorials at the Faculty of Physics, University of Warsaw:

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| 2014/2015 | Green function method in condensed matter physics (tutorial, 30h) |
| 2012/2013 | Green function method in condensed matter physics (tutorial, 30h) |
| 2007/2008 | Mechanics of continuous media (tutorial, 30h) |
| 2007/2008 | Classical Mechanics (tutorial, 30h) |
| 2006/2007 | Electrodynamics of material media (tutorial, 45h) |

2006/2007	Statistical Mechanics (tutorial, 30h)
2005/2006	Phenomenological Thermodynamics (tutorial, 30h)
2005/2006	Statistical Physics (tutorial, 45h)

Others:

- 2010: START courses for students of Faculty of Physics, University of Warsaw (physics, 30h)
- 2006/2007: Course preparing for school leaving exam, Collegium Novum, Warsaw (mathematics, 45h)

STUDENTS SUPERVISION

- Banhi Chatterjee (2017, PhD in physics, University of Warsaw, as a co-supervisor)
- Jean-Baptiste Gorce (2016, master internship in IPC PAS from ESPCI Paris, as a co-supervisor)

CONFERENCES AND WORKSHOPS

- 2019: 72nd Annual Meeting of the American Physical Society's Division of Fluid Dynamics, Seattle, USA
- 2019: Cell Physics 2019, Saarbrücken, Germany
- 2018: "7th European Conference on Computational Fluid Dynamics", Glasgow, Scotland
- 2018: "Colloidal, Macromolecular & Polyelectrolyte Solutions", GRC, Ventura, USA
- 2017 "Frontiers in Physical Chemistry Symposium", Caltech, Pasadena, USA
- 2016: „6th Warsaw School of Statistical Physics”, Sandomierz, Poland
- 2015: "Nonequilibrium Collective Dynamics: Bridging the Gap between Hard and Soft Materials" Potsdam, Germany
- 2015: „Deutsche Physikalische Gesellschaft Spring Meeting”, Berlin, Germany
- 2014: "From Spins to Cooper Pairs", 650th Jubilee of the Jagiellonian University, Zakopane, Poland
- 2014: „Correlated Electron Systems”, GRC, South Hadley, USA
- 2014: „Colloidal, Macromolecular & Polyelectrolyte Solutions”, GRC, Ventura, USA,
- 2013: „International Conference on Statistical Physics”, Seoul, Republic of Korea
- 2013: „The New Generation in Strongly Correlated Electron Systems”, Sestri Levante, Italy
- 2013: „5th Warsaw School of Statistical Physics”, Kazimierz Dolny, Poland,
- 2013: „Deutsche Physikalische Gesellschaft Spring Meeting”, Regensburg, Germany
- 2009: „3rd Warsaw School of Statistical Physics”, Kazimierz Dolny, Poland,
- 2008: „7th Liquid Matter Conference”, Lund, Sweden,
- 2007: „International Soft Matter Conference”, Aachen, Germany
- 2007: „2nd Warsaw School of Statistical Physics”, Kazimierz Dolny, Poland,
- 2005: „1st Warsaw School of Statistical Physics”, Kazimierz Dolny, Poland

POPULARIZATION OF SCIENCE

- "Electricity from the Sun – photovoltaic cells (part I)" (in polish)
Lecture, XVII Science Festival, Faculty of Physics, University of Warsaw, 28.09.2013
- „Magnetorheological liquid and fast off-road drive” (in polish)
Lecture, XVI Science Festival, Faculty of Physics, University of Warsaw, 30.09.2012

OTHER ACTIVITY

- 2009: member of local organizing committee of „3rd Warsaw School of Statistical Physics”, Kazimierz Dolny, Poland,
- 2011: representative of Ph.D. students at Institute of Theoretical Physics Council at the Faculty of Physics University of Warsaw