Dr Aljaz Godec

Emmy Noether group Mathematical bioPhysics, Max Planck Institute for Multidisciplinary Sciences
(formerly Max Planck Institute for Biophysical Chemistry)

30th October 2022

Personal data:

Family name, first name: Godec Aljaz
Date of birth: 22nd February 1984 (Maribor, Slovenia)
Nationality: Slovenia
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Secretary: Ms. Eveline Heinemann & Ms. Stefanie Teichmann
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Education and Positions:

Diploma (2007) and Doctorate (2012), University of Ljubljana, Slovenia

2017 - present	head of the Mathematical bioPhysics Group, Max Planck Institute for Multidisciplinary Sciences, Göttingen, Germany (formerly Max Planck Institute for Biophysical Chemistry) (hosted by Prof. Helmut Grubmüller)
2014 - 2017	Alexander von Humboldt postdoctoral fellow, Theoretical Physics at the Institute of Physics and Astronomy, University of Potsdam, Germany (with Prof. Ralf Metzler)
2013 - 2017	research associate, Theory Department, National Institute of Chemistry (NIC), Ljubljana, Slovenia (on leave)
2012 - 2014	postdoctoral fellow, Theoretical Physics at the Institute of Physics and Astronomy, University of Potsdam, Germany (with Prof. Ralf Metzler)
2012 - 2013	research fellow, Theory Department, National Institute of Chemistry, Ljubljana, Slovenia (on leave)
2007 - 2012	young researcher, Theory Department, NIC Ljubljana, Slovenia

Other education and training:

2021 Training on "Unconscious bias & thought patterns" – workshop on gender-IQ
2009 Training on intellectual property, patent practice and academics entrepreneurship (workshop organized by the Slovenian research agency ARRS in Ljubljana)
2008 39th IFF Spring School on soft matter physics: Soft Matter – From Synthetic to Biological Materials, Research Centre Jülich (GER)

Languages:

Slovene (mother tongue), English (proficient), German (proficient); FORTRAN (proficient), Mathematica (proficient)

Publications and citations:

62 journal articles, 1 book chapter; Hirsch factor (H-index): Web of Science 21, Google Scholar 23; Citations: >1560 citations; >45 citations in 2014, >70 citations in 2015, >80 citations in 2016, >100 citations in 2017, >100 citations in 2018, >150 citations in 2019, >220 citations in 2020, >240 citations in 2021, >230 citations in 2022 (so far)

Awards, prizes and honors:

2020 Institute of Physics (IOP) trusted reviewer
2020 Outstanding Reviewer for Journal of Physics A: Math. Theor.
2017 Karl-Scheel Prize of the Berlin Physical Society (PGzB)
2017 Academy of Finland Fellow (declined)
2017 DFG Emmy Noether group
2016 Journal of Physics A Emerging talent
2016 PKS Distinguished Postdoctoral Fellow (declined)
2015 participant in the 65$^{\text{th}}$ Lindau Nobel laureate meeting
2015 Josef Stefan Golden Emblem Prize for PhD thesis with the highest impact
2014 Alexander von Humboldt fellowship for postdoctoral researchers
2012 Pregl award for exceptional PhD thesis
1998- 2007 Zois scholarship for gifted students

Recent Conferences and Seminars/Workshops (since 2020) ($*$ = virtual)

2022 CPTS Symposium of the Max Planck Society, Harnack house Berlin (GER) - *Time-reversal symmetry and dissipation in dynamics with memory* (invited talk)
2022 BMS Symposium of the Max Planck Society, Harnack house Berlin (GER) - *Biological challenges for non-equilibrium physics* (invited talk)
2022 Venice meeting on Fluctuations in small complex systems VI (ITA) - *Time (ir)reversibility in the presence of memory* (invited talk)
2022 WE-Heraeus-Seminar on "Entropy and the Second Law of Thermodynamics –" "The past, the present, and the future", Physikzentrum Bad Honnef (GER) - *Time-reversal symmetry and dissipation in dynamics with memory* (invited talk)
2022 Non-Markovian dynamics far from equilibrium, ICTP Trieste (ITA) - *Time-reversal symmetry and dissipation in dynamics with memory* (invited talk)
2022 DFG Research Unit FOR-5099 Colloquium, University of Freiburg (GER) - *Physics of shadows: thermodynamic implications of memory in coarse-grained dynamics* (invited talk $*$)
2022 Physics Colloquium, CUA Washington (USA) - *Physics of shadows: thermodynamic implications of memory in low-dimensional observables* (invited talk $*$)
2021 Venice meeting on Fluctuations in small complex systems V (ITA) - *Criticality in stochastic many-body systems: from cell adhesion to the Ising model (and back)* (invited talk)

2021 Physics Colloquium, Northwestern Polytechnical University (China) - *Observing Shadows: Mathematical Signatures of Memory and Their Physical Interpretation* (invited talk; virtual)
2021 Physics & Applied Mathematics Colloquium, University of Shanghai (virtual) - *Observing Shadows: Mathematical Signatures of Memory and Their Physical Interpretation* (invited talk)
2021 DPG Spring Meeting (virtual) - *Small diffusive systems warm up faster than they cool down* (invited talk / "Hauptvortrag")
2021 APS March Meeting (virtual) - *Small systems warm up faster than they cool down* (contributed talk)
2020 Physics colloquium, NORDITA Stockholm (SWE) - *Why small systems warm up faster than they cool down* (invited talk)

Research funding and supervision:

Funding: - Emmy Noether research group, German Research Foundation (DFG) (2017-2023; ∼1.7 million EUR)
- Academy of Finland Fellow (declined), Academy of Finland (2017-2022, ∼440 K EUR)
- Humboldt Fellowship for Postdoctoral Researchers, Alexander von Humboldt foundation (2014-2017; 125 K EUR)
- Independent research project, Slovenian Research Agency ARRS (2016-2017, 50 K EUR)
pending:
- ERC consolidator grant 2022
- Henriette Herz-Scouting-Programme (Alexander von Humboldt Foundation)

Supervision:

Completed: BSc Theses: Oliver Kindler (2014), Alex Berdin (2014), and Markus Dahlenburg (2015) [co-supervisor, University of Potsdam]
Michelle Kemper (2019), Mathematics Dept. Univ. Göttingen, [co-supervision with Prof. Anja Sturm]
Santiago Carrero Ibanez, Mathematics Dept. Univ. Göttingen,
Diploma Thesis: Ivan Jamnik (2012) [co-supervisor, University of Ljubljana]
MSc Theses: Maria Schwarzl, (2014) [co-supervisor, University of Potsdam],
Janik Schüttler (2021), Physics Dept. ETH Zürich [co-supervision with Prof. Matthias Krüger]
PhD Theses: Henning Krüsemann (2016) [co-supervisor, University of Potsdam]
Alessio Lapolla (2021), Physics Dept. & GGNB-PBCS, Univ. Göttingen
Maximillian Vossel (2022) Physics Dept. & GGNB-PBCS, Univ. Göttingen

Ongoing: BSc Theses:
Santiago Carrero Ibanez (since Mar. 2022), Physics Dept. Univ. Göttingen
MSc Theses:
Gerrit Wellecke (since Oct. 2021), Physics Dept. Univ. Göttingen
PhD Theses:
Kristian Blom (since Sep. 2018), Cai Dieball (since Oct. 2019),
Rick Bebon (since Jan. 2022)

Refereeing

Referee for: Science Advances; PNAS; Physical Review Letters; Physical Review X; Physical Review Research; Physical Review E; New Journal of Physics; Journal of Statistical Mechanics; Journal of Chemical Physics; Scientific Reports; Soft Matter; Journal of Physics A: Mathematical and Theoretical; Biophysical Journal; Biophysical Reports; PlosONE; Proceedings of the Royal Society A; Chaos, Solitons & Fractals; Journal of Biological Physics;

Biophysical Journal; Europhysics Letters; Langmuir; Physics Letters A; Applied Mathematics and Computation; Physica A; Physical Biology; Acta Biomaterialia

Editorial role

Associate editor for: Frontiers in Physics

Teaching experience

i) Full faculty member of GGNB (Göttingen Graduate School for Neurosciences, Biophysics, and Molecular Biosciences) & GAUSS (Georg-August University School of Science)

ii) Lecturing:
- *Current Topics in Theoretical Physics*, Masters program in Physics (Univ. of Göttingen)
- *Advanced Mathematical Methods in Statistical Mechanics* (GGNB/GAUSS graduate course in the program 'Physics of Biological and Complex systems' – PBCS)
- *Advanced Computational Methods in Statistical Mechanics* (GGNB/GAUSS graduate course in the program 'Physics of Biological and Complex systems' – PBCS)
- *Current Topics in Biophysics* (GGNB/GAUSS program PBCS)
- *Theoretical Physics* and *Theory and applications of stochastic processes* and *Biophysics* (at Univ. of Potsdam, substituting for Prof. Ralf Metzler)

1 LIST OF PUBLICATIONS

A Manuscripts under review:

A.1 K. Blom & **A. Godec**, *Global Speed Limit for Finite-Time Dynamical Phase Transition in Nonequilibrium Relaxation.* Under review (2022) (arXiv:2209.14287)

A.2 C. Diebal & **A. Godec**, *Direct Route to Thermodynamic Uncertainty Relations.* Under review (2022) (arXiv:2206.04034)

A.3 C. Diebal & **A. Godec**, *On correlations and fluctuations of time-averaged densities and currents with general time-dependence.* Under review (2022) (arXiv:2208.05460)

A.4 C. Diebal & **A. Godec**, *Feynman-Kac theory of time-integrated functionals: Itô versus functional calculus.* Under review (2022) (arXiv:2206.04034)

A.5 K. Blom, N. Ziethen, D. Zwicker, & **A. Godec**, *Delocalization-induced interface broadening in strongly interacting systems.* Under review (2022). (arXiv:2204.02962)

A.6 D. Hartich & **A. Godec**, *Comment on "Inferring broken detailed balance in the absence of observable currents".* Revised version under review (2022). (arXiv:2112.08978)

A.7 D. Hartich & **A. Godec**, *Violation of local detailed balance despite a clear time-scale separation.* Revised version under review (2022). (arXiv:2111.14734)

B Journal articles:

B.1 C. Dieball & **A. Godec**, *Mathematical, Thermodynamical, and Experimental Necessity for Coarse Graining Empirical Densities and Currents in Continuous Space.* Phys. Rev. Lett. **129**, 140601 (2022). [See accompanying **press release**.]

B.2 C. Dieball & **A. Godec**, *Coarse Graining Empirical Densities and Currents in Continuous-Space Steady States.* Phys. Rev. Research **4**, 033243 (2022).

B.3 J. Li, J-F. Xie, **A. Godec**, K. R. Weninger, C. Liu, J. C. Smith, & L. Hong, *Non-ergodic internal dynamics of a globular protein observed over fourteen orders in time.* Chem. Sci. **13**, 9668 (2022).

B.4 C. Zunke, J. Bewerunge, F. Platten, S. Egelhaaf, & **A. Godec**, *First passage statistics of colloids on fractals: theory and experimental realization.* Science Advances **8**, eabk0627 (2022). [Covered in **ProPhysik** magazine.]

B.5 C. Dieball, D. Krapf, M. Weiss, & **A. Godec**, *Scattering fingerprints of two-state dynamics.* New J. Phys. **24**, 023004 (2022).

B.6 D. Hartich & **A. Godec**, *Emergent memory and kinetic hysteresis in strongly driven networks.* Phys. Rev. X **11**, 041047 (2021).

B.7 K. Blom & **A. Godec**, *Criticality in Cell Adhesion.* Phys. Rev. X **11**, 031067 (2021). [See accompanying **press release**.]

B.8 D. Hartich & **A. Godec**, *Thermodynamic Uncertainty Relation Bounds the Extent of Anomalous Diffusion.* Phys. Rev. Lett. **127**, 080601 (2021). [**Editors' Suggestion** & covered in a **Viewpoint in *Physics***]

B.9 A. Lapolla & **A. Godec**, *BetheSF V2: 3-point propagator and additional external potentials.* Comp. Phys. Commun. **269**, 108131 (2021).

B.10 A. Lapolla, M. Vossel, & **A. Godec**, *Time- and ensemble-average statistical mechanics of the Gaussian Network Model.* J. Phys. A: Math. Theor. **54**, 355601 (2021).

B.11 J. Li, X. Hu, T. Neusius, X. Cheng, M. D. Smith, **A. Godec**, L. Hong, R. Metzler, and J. C. Smith, *Reply to: Insufficient evidence for ageing in protein dynamics.* Nature Phys., **17**, 775 (2021).

B.12 A. Lapolla & **A. Godec**, *A Toolbox for Quantifying Memory in Dynamics Along Reaction Coordinates.* Phys. Rev. Research **3**, L022018 (2021).

B.13 A. Lapolla & **A. Godec**, *Single-file diffusion in a bi-stable potential: signatures of memory in the barrier-crossing of a tagged-particle.* J. Chem. Phys. **153**, 194104 (2020).

B.14 A. Lapolla & **A. Godec**, *Faster uphill relaxation in thermodynamically equidistant temperature quenches.* Phys. Rev. Lett. **125**, 110602 (2020); see Erratum with corrected Proof of Theorem 1. [**Editors' Suggestion** & covered in a **Focus story in *Physics*** and a **commentary in *Physics World***.]

B.15 A. Lapolla, D. Hartich, & **A. Godec**, *Spectral theory of fluctuations in time-average statistical mechanics of reversible and driven systems.* Phys. Rev. Research **2**, 043084 (2020).

B.16 A. Lapolla & **A. Godec**, *BetheSF: Efficient computation of the exact tagged-particle propagator in single-file systems via the Bethe eigenspectrum.* Comp. Phys. Commun. **258**, 107569 (2021).

B.17 T. Ukmar-Godec, P. Fang, A. Ibáñez de Opakua, F. Henneberg, **A. Godec**, M.-S. Cima-Omori, A. Chari, E. Mandelkow, H. Urlaub & M. Zweckstetter, *Proteasomal degradation of the intrinsically disordered protein tau at single-residue resolution.* Science Advances **6**, eaba3916 (2020).

B.18 A. Lapolla and **A. Godec**, *Manifestations of projection-induced memory: general theory and the tilted single file.*, Front. Phys. **7**, 182 (2019).

B.19 D. Hartich and **A. Godec**, *Extreme value statistics of ergodic Markov processes from first passage times in the large deviation limit*, J. Phys. A: Math. Theor. **52**, 244001 (2019). (Invited for a special issue 'New trends in first-passage methods and applications in the life sciences and engineering')

B.20 D. Hartich and **A. Godec**, *Interlacing Relaxation and First-Passage Phenomena in Reversible Discrete and Continuous Space Markovian Dynamics*, J. Stat. Mech. **024002** (2019) (arxiv.org/abs/1802.10049).

B.21 D. Hartich and **A. Godec**, *Duality between relaxation and first passage in reversible Markov dynamics: rugged energy landscapes disentangled*, New J. Phys. (Fast Track Communication), **20**, 112002 (2018).

B.22 A. Lapolla and **A. Godec**, *Unfolding tagged Particle Histories in Single-File Diffusion: Exact Single- and Two-Tag Local Times Beyond Large Deviation Theory*, New J. Phys. **20**, 113021 (2018).

B.23 M. Schwarzl, **A. Godec** and R. Metzler, *Quantifying non-ergodicity of anomalous diffusion with higher order moments*, Sci. Rep., **7**, 3878 (2017).

B.24 T. Ukmar-Godec, L. Bertinetti, J. Dunlop, **A. Godec**, M. Grabiger, A. Masic, H. Nguyen, I. Zlotnikov, P. Zaslansky and D. Faivre, *Materials Nanoarchitecturing via Cation-Mediated Protein Assembly: Making Limpet Teeth without Mineral*, Adv. Mat., 1701171 (2017).

B.25 **A. Godec** and R. Metzler, *First passage-time statistics for two-channel diffusion*, J. Phys. A: Math. Theor. **50**, 084001 (2017) (Invited for a special issue 'Emerging talents')

B.26 **A. Godec** and R. Metzler, *Universal proximity effect in target search kinetics in the few-encounter limit*, Phys. Rev. X, **6**, 041037 (2016).

B.27 **A. Godec** and R. Metzler, *Active transport improves the precision of linear long distance molecular signalling*, J. Phys. A: Math. Theor. **49**, 364001 (2016) [Invited for a special issue on Marian Smoluchowski's 1916 paper – a century of inspiration]

B.28 M. Schwarzl, **A. Godec**, G. Oshanin and R. Metzler, *A single predator charging a herd of prey: effects of self volume and predator-prey decision-making*, J. Phys. A: Math. Theor. **49**, 225601 (2016). (see also accompanying press release: http://phys.org/news/2016-04-theoretical-tiger-statistical-sheep-probe.html)

B.29 **A. Godec** and R. Metzler, *First passage time distribution in heterogeneity controlled kinetics: going beyond the mean first passage time*, Sci. Rep. **6**, 20349 (2016).

B.30 **A. Godec** and R. Metzler, *Signal focusing through active transport*, Phys. Rev. E **92**, 010701(R) (2015).

B.31 H. Krüsemann, **A. Godec** and R. Metzler, *Ageing first passage time density in continuous time random walks and quenched energy landscapes*, J. Phys. A: Math. Theor. **48**, 285001 (2015). (selected by the editorial board as highlight for IOP-select)

B.32 **A. Godec** and R. Metzler, *Optimization and universality of Brownian search in a basic model of quenched heterogeneous media*, Phys. Rev. E **91**, 052134 (2015).

B.33 **A. Godec**, A. V. Chechkin, E. Barkai, H. Kantz and R. Metzler, *Localisation and universal fluctuations in ultraslow diffusion processes*, J. Phys. A: Math. Theor. (FTC) **47**, 492002 (2014). (selected as 2014 Highlight of J. Phys. A)

B.34 M. Bauer, **A. Godec** and R. Metzler, *Diffusion of finite-size particles in two-dimensional channels with random wall configurations*, Phys. Chem. Chem. Phys. **16**, 6118 (2014).

B.35 **A. Godec**, M. Bauer and R. Metzler, *Collective dynamics effect transient subdiffusion of inert tracers in flexible gel networks*, New. J. Phys. (FTC) **16**, 092002 (2014). (selected as New. J. Phys. Highlight 2014)

B.36 H. Krüsemann, **A. Godec** and R. Metzler, *First-passage statistics for aging diffusion in systems with annealed and quenched disorder*, Phys. Rev. E **89**, 040101(R) (2014).

B.37 **A. Godec**, J. C. Smith and F. Merzel, *Soft collective fluctuations governing hydrophobic association*, Phys. Rev. Lett. **111**, 127801 (2013).

B.38 **A. Godec** and R. Metzler, *Linear response, fluctuation-dissipation relation, and finite-system-size effects in superdiffusion*, Phys. Rev. E **88**, 012116 (2013).

B.39 **A. Godec** and R. Metzler, *Finite-Time Effects and Ultraweak Ergodicity Breaking in Superdiffusive Dynamics*, Phys. Rev. Lett. **110**, 020603 (2013).

B.40 **A. Godec** and F. Merzel, *Physical origin underlying the entropy loss upon hydrophobic hydration* J. Am. Chem. Soc. **134**, 17574 (2012).

B.41 T. Ukmar, U. Maver, O. Planinšek, A. Pintar, V. Kaučič, **A. Godec** and M. Gaberšček, *Guest-host van der Waals interactions decisively affect the molecular transport in mesoporous media*, J. Mater. Chem. **22**, 1112 (2012).

B.42 **A. Godec**, J. C. Smith and F. Merzel, *Increase of both order and disorder in the first hydration shell with increasing solute polarity*, Phys. Rev. Lett. **107**, 267801 (2011).

B.43 A. Žnidaršič, **A. Godec** and M. Gaberšček. *pH-based one pot synthesis of biocompatible olive shaped inorganic particles*, Mater. Res. Bull. **47**, 967 (2012).

B.44 T. Ukmar, U. Maver, O. Planinšek, A. Pintar, V. Kaučič, M. Gaberšček and **A. Godec**, *Understanding controlled drug release from mesoporous silicates: Theory and Experiment*, J. Control. Rel. **155**, 409 (2011).

B.45 T. Ukmar, M. Gaberšček, F. Merzel and **A. Godec**, *Modus operandi of controlled release from mesoporous matrices: a theoretical perspective*, Phys. Chem. Chem. Phys. **13**, 15311 (2011).

B.46 T. Ukmar, **A. Godec**, O. Planinšek, V. Kaučič, G. Mali and M. Gaberšček, *Phase (trans)formation and physical state of a model drug in mesoscopic confinement* Phys. Chem. Chem. Phys. **13**, 16046 (2011).

B.47 **A. Godec**, T. Ukmar, M. Gaberšček and F. Merzel, *Inversion of pore size dependence of solute transport kinetics from increasingly attractive ordered porous matrix*, Europhys. Lett. **92**, 60011 (2010).

B.48 U. Maver, A. Žnidaršič, D. Saboti, S. Srčič, M. Gaberšček, **A. Godec** and O. Planinšek, *The relation between the interfacial contact and SiO_2 coating efficiency and properties in the case of two clarithromycin polymorphs*, Coll. Surf. A: Physicochem. Eng. Aspects **371**, 119 (2010).

B.49 **A. Godec**, M. Gaberšček, J. Jamnik, D. Janežič and F. Merzel, *Ion-size effect within the aqueous solution interface at the Pt(111) surface : molecular dynamics studies*, Phys. Chem. Chem. Phys. **12**, 13566 (2010).

B.50 O. Planinšek, J. Zadnik, M. Kunaver, S. Srčič and **A. Godec**, *Structural evolution of indomethacin particles upon milling: time-resolved quantification and localization of disordered structure studied by IGC and DSC*, J. Pharm. Sci. **99**, 1968 (2010).

B.51 **A. Godec**, M. Gaberšček, J. Jamnik and F. Merzel, *14. Nonlinear diffusion in two-dimensional ordered porous media based on a free volume theory*, J. Chem. Phys. **131**, 234106 (2009).

B.52 T. Ukmar, **A. Godec**, U. Maver, O. Planinšek, M. Bele, J. Jamnik and M. Gaberšček, *Suspensions of modified TiO_2 nanoparticles with supreme UV filtering ability*, J. Mater. Chem. **19**, 8176 (2009).

B.53 **A. Godec**, M. Gaberšček and J. Jamnik, *Comment on the article "A new understanding of the relationship between solubility and particle size"*, J. Sol. Chem. **38**, 135 (2009).

B.54 **A. Godec**, U. Maver, M. Bele, O. Planinšek, S. Srčič, M. Gaberšček and J. Jamnik, *Vitrification from solution in restricted space: formation and stabilization of amorphous nifedipine in a nanoporous silica xerogel carrier*, Int. J. Pharm. **343**, 131 (2007).

B.55 U. Maver, **A. Godec**, M. Bele, O. Planinšek, S. Srčič, M. Gaberšček and J. Jamnik, *Novel hybrid silica xerogels for stabilization and controlled release of drug*, Int. J. Pharm. **330**, 164 (2007).

C Chapters in books

C.1 D. Hartich & **A. Godec**, *Reaction kinetics in the few-encounter limit*. In *CHEMICAL KINETICS BEYOND THE TEXTBOOK*, Ed: K. Lindenberg, R. Metzler, & G. Oshanin. (World Scientific, 2019, in press) [https://doi.org/10.1142/q0209].