

# Christian Schilling

---

**CONTACT INFORMATION** Christian Schilling  
Arnold-Sommerfeld Center for Theoretical Physics  
Ludwig Maximilian University of Munich  
Theresienstr. 37, 80333 Munich  
*Phone:* +49 (0)89 2180 4594  
*Email:* c.schilling@physik.uni-muenchen.de  
*website:* [https://www.theorie.physik.uni-muenchen.de/lsschollwoeck/schilling\\_group/index.html](https://www.theorie.physik.uni-muenchen.de/lsschollwoeck/schilling_group/index.html)



**PERSONAL INFORMATION** born October 13, 1984, Basel, Switzerland  
*Nationality:* German

**CURRENT RESEARCH INTERESTS**

- Foundation of entanglement in fermionic quantum systems
- Numerical methods for strongly correlated electrons based on new tools from Quantum Information Theory
- Quantum Computing in Quantum Chemistry
- Density Matrix Renormalization Group (DMRG) approach in Quantum Chemistry and Quantum Optics
- Reduced Density Matrix Functional Theory (RDMFT)
- Quantum marginal problem and geometry of quantum states

**RESEARCH CAREER**

<b>Emmy-Noether research group leader at LMU Munich</b>	<b>since 8/2019</b>
<b>Research Fellow at Wolfson College Oxford</b>	<b>1/2019-12/2020</b>
<b>EPSRC Postdoctoral Fellow at University of Oxford in the group of Vlatko Vedral</b>	<b>12/2016-7/2019</b>
<b>Postdoc at University of Oxford, United Kingdom in the group of Vlatko Vedral</b>	<b>9/2015-11/2016</b>
<b>Postdoc at University of Oxford, United Kingdom in the group of Dieter Jaksch</b>	<b>3/2014-8/2015</b>

**EDUCATION**

<b>PhD program at ETH Zurich, Switzerland</b> under supervision of <b>Matthias Christandl</b> on the <b>Quantum marginal problem and its physical relevance</b>	<b>1/2010 - 2/2014</b>
<b>Research stay at ETH Zurich, Switzerland</b> with <b>Jürg Fröhlich</b>	<b>10/2009 - 12/2009</b>
<b>Diploma thesis (external) at ETH Zurich, Switzerland</b> under supervision of <b>Jürg Fröhlich</b> (title: Some Fundamental Aspects of Standard Quantum Theory)	<b>9/2008 - 9/2009</b>
<b>Studies of Physics at University of Mainz, Germany</b> final mark: 1.0 (scale from 1.0 to 6.0)	<b>4/2004 - 9/2009</b>

TEACHING EXPERIENCE	<b>Lecture</b> (90 hours) on Quantum Information Theory LMU Munich & TU Munich	10/2023-2/2024
	<b>Seminar</b> (26 hours) on Quantum Information Theory meets Quantum Many-Body Physics, LMU Munich	4-7/2023
	<b>Lecture</b> (90 hours) on Quantum Information Theory LMU Munich & TU Munich	10/2022-2/2023
	<b>Seminar</b> (26 hours) on Quantum Information Theory meets Quantum Many-Body Physics, LMU Munich	4-7/2022
	<b>Lecture</b> (90 hours) on Mathematical Quantum Mechanics equally shared with Peter Müller, LMU Munich	10/2021-2/2022
	<b>Lecture</b> (12 hours) on Quantum Information Theoretical Aspects in Quantum Many-Body Physics, LMU Munich	1-3/2020
	<b>Lecture</b> (22 hours) on Quantum Information Processing, including, e.g., the geometry of quantum states, the concept of correlation, quantum computing, University of Oxford	1-6/2019
	<b>Lecture</b> (6 hours) on Quantum Information Processing, University of Oxford	4&5/2018
	<b>Invited lecture</b> (8 hours) on Quantum Information Theory, UNESP Sao Paulo	10/2017
	<b>Lecture</b> (6 hours) on Quantum Information Processing, including, e.g., the geometry of quantum states and the concept of correlation, University of Oxford	4&5/2017
<b>Leading exercise classes</b> in Theoretical Physics at ETH Zurich	9/2010 - 12/2013	
SUPERVISION	- Supervision of PhD student Damiano Aliverti-Piuri on "Quantum computing fermionic ground states"	since 8/2023
	- Supervision of Master student Laura Herzog on "Entanglement spectrum in quantum chemistry"	since 4/2023
	- Supervision of Master student Martin Uttendorfer on "Functional theory for quantum phase transitions"	since 4/2023
	- Supervision of PhD student Cheng-Lin Hong on "Variational quantum eigensolver for excited states"	since 11/2022
	- Supervision of PhD student Kaustav Chatterjee on "Orbital optimization in DMRG"	since 10/2022
	- Supervision of Master student Martina Jung on "Bogoliubov theory for hard-core bosons"	10/2022-7/2023
	- Supervision of Master student Damiano Aliverti-Piuri on "Fermionic particle entanglement"	8/2022-7/2023

- Supervision of Master student Rolando Reiner on "Qubit functional theory: Foundation and description of quantum phase transitions" 10/2021-9/2022
- Supervision of Master student Lukas Kienesberger on "The curse of universality in functional theory" 10/2021-7/2023
- Supervision of PhD student Julia Liebert on "Quantum information theoretical approach to functional theories" since 4/2021
- Supervision of PhD student Lexin Ding on "Entanglement in strongly correlated fermionic quantum systems" since 10/2020
- Supervision of Master student Julia Liebert on "Reduced density matrix functional theory for dilute Bose gases" 3/2020-2/2021
- Supervision of Master student Lexin Ding on the "Concept of fermionic entanglement" 10/2019-9/2020
- Supervision of Master student Suwanja Srikantha on "Entanglement analysis in an analytically solvable model" 10/2018-4/2019
- Supervision of Master student Mason Yousif on "Solving the "Hubbard-wheel": Interpolation between one and infinite dimensions" 10/2018-4/2019
- Supervision of Master student Macauley Davy on "Exclusion principle for hard-core bosons" 10/2017-4/2018
- Supervision of Master student Dylan Lewis on "Revealing ground state symmetries through the analysis of occupation numbers" 10/2016-4/2017
- Co-supervision of PhD student Felix Tennie on the "Influence of the Exchange Symmetry beyond the Exclusion Principle" 2/2015-12/2016
- Co-supervision of Daniel Ebler's Master thesis on the "*N*-representability problem for the Borland-Dennis setting" 9/2013 - 1/2014
- Co-supervision of Master student Daniel Ebler in a four months project on "Pinning in 4-Harmonium" 2/2013 - 5/2013

In addition, I was serving as formal supervisor at LMU Munich and examiner for PhD student Christoph S underhauf, Master student Duc Viet Hoang and Bachelor students Simon Eisenmann, Kadir Burak Karli and Kshiti Sneh Rai

- |                         |  |
|-------------------------|--|
| AWARDS/<br>DISTINCTIONS | <ul style="list-style-type: none"> <li>• Admittance to the Emmy-Noether programme <span style="float: right;">8/2019-7/2025</span></li> <li>• Senior Research fellowship at Wolfson College Oxford awarded for seven years <span style="float: right;">1/2019-12/2020</span></li> <li>• "Award for Excellence" from the University of Oxford (worth € 2850) <span style="float: right;">3/2017</span></li> <li>• EPSRC Postdoctoral fellowship (for three years), ranked as No 1 in Physical Sciences in UK <span style="float: right;">12/2016-7/2019</span></li> <li>• Junior Research fellowship at Worcester College Oxford (150 applicants for two positions) <span style="float: right;">10/2016-9/2018</span></li> <li>• Oxford Martin school sponsored an international workshop on the research field I have opened <span style="float: right;">4/2016</span></li> <li>• James-Martin fellowship from the Oxford Martin School <span style="float: right;">9/2015-11/2016</span></li> <li>• "Early Postdoc.Mobility"-fellowship from the Swiss National <span style="float: right;">3/2014 - 8/2016</span></li> </ul> |
|-------------------------|--|

Science Foundation for a project on "Structural Aspects of Fermionic Quantum States" (funding for 3/2014 - 8/2015)

FELLOWSHIPS/  
EXTERNAL  
GRANTS

- Funding from Munich Quantum Valley awarded in 10/2021, **€1.100.000**
- Emmy-Noether grant awarded in 5/2019, **€1.575.000**
- EPSRC Postdoctoral fellowship awarded in 9/2016, **€310.000**
- SNSF "Early Postdoc.Mobility"-fellowship awarded in 11/2013, **€71.000**
- Funding for Munich-workshop awarded by MCQST in 06/2021, **€10.000**
- Funding for Lausanne-workshop awarded by CECAM in 12/2019, **€13.000**
- Funding for San Sebastian-workshop from DIPC, **€12.000**
- Funding for Lausanne-workshop awarded by CECAM in 11/2016, **€12.000**
- Funding for Lausanne-workshop awarded by Psi-k in 12/2016, **€5.000**
- Funding for Lausanne-workshop from the Max-Planck society (3/2017), **€10.000**
- Funding for Oxford-workshop from the Oxford Martin School (4/2016), **€12.000**

TALKS

in total **122 talks** at conferences, workshops and seminars, among those 22 invited talks at international conferences and one invited lecture, e.g.,

- **A quantum information-inspired approach to the electron correlation problem**  
"The Theory Meeting for Theoreticians",  
63rd Sanibel Symposium, Florida 2/2024
- **A unifying perspective on fermionic correlation and the ground state problem**  
"Tensor product methods for strongly correlated molecular systems",  
Max Planck Institute for the Physics of Complex Systems 3/2021
- **The Electron Correlation Problem from a Quantum Information Perspective**  
"Munich Conference on Quantum Science and Technology 2020",  
Munich Center for Quantum Science and Technology (MCQST) 7/2020
- **Introduction into fermionic correlation and applications in quantum chemistry**  
"Entanglement Days", Budapest University of Technology and Economics 9/2018
- **Introduction to generalized Pauli constraints and their applications**  
"50 Symposium on Mathematical Physics", University of Torun 6/2018
- **Lecture on Quantum Information Theory**  
"School on Density Functional Theory and Quantum Information Theory",  
ICTP-SAIFR/IFT-UNESP Sao Paulo 11/2017
- **Fermionic Exchange Symmetry: Quantifying its Influence beyond Pauli's Exclusion Principle**  
"Quantum Science Symposium (QSS) Europe", University of Cambridge 11/2016
- **One-fermion picture for Moshinsky-type atoms and significance of generalized Pauli constraints**  
"Computational Mathematical Methods in Science and Engineering", Cadiz 6/2016
- **Pinning of Fermionic Occupation Numbers**  
"Quantum Marginals", University of Cambridge 10/2013
- **Quantum Marginal Problem and its Physical Relevance**  
International conference on "Mathematical Results in Quantum Mechanics",  
Berlin (QMath12) 9/2013

	<ul style="list-style-type: none"> <li>- <b>Decoherence and Indeterminism in Standard Quantum Theory</b> conference on "Quantum Computation", Tokyo University 4/2010</li> </ul>
ORGANISATION OF EVENTS	<ul style="list-style-type: none"> <li>- Organisation of the 4-day international workshop <b>"Reduced Density Matrix Theory and the N-representability Problem"</b> together with David Mazziotti and Mario Piris in San Sebastian in June 2022</li> <li>- Organisation of the 4-day <b>International Symposium on Correlated Electrons (SymCorrel21)</b>" together with David Mazziotti, online in October 2021</li> <li>- Organisation of the 4-day international workshop <b>"New challenges in Reduced Density Matrix Functional Theory: Symmetries, time-evolution and entanglement"</b> together with Carlos Benavides-Riveros, Eberhard Gross, Miguel Marques in Lausanne in September 2017 and in Trento in October 2022</li> <li>- Organisation of the workshop <b>"Generalized Pauli Constraints and Fermion Correlation"</b> together with Alex Gottlieb in Vienna in August 2016</li> <li>- Organisation of a 4-day international workshop in Oxford in April 2016 on <b>"Reduced Density Matrices in Quantum Physics and Role of Fermionic Exchange Symmetry"</b> with Vlatko Vedral; 18 invited speakers, among others: D.Haldane, J.M.Leinaas, J.Myrheim, D.Mazziotti and U.Schollwöck</li> <li>- Organisation of the 1-day student workshop <b>"Pauli2016 WarmUp"</b> in April 2016 as preparation for our international workshop</li> </ul>
FURTHER ACTIVITIES/ MEMBERSHIPS	<ul style="list-style-type: none"> <li>- refereeing for various journals in Physics and Chemistry</li> <li>- lifetime membership in Swiss Physical Society</li> <li>- member of steering committee of the International Max-Planck Research School (IMPRS-QST) on quantum science and technology</li> <li>- several training courses attended by the "Munich Center for Quantum Science and Technologies" on leadership, conflict management &amp; modern teaching</li> <li>- organisation of online series on Quantum Information Theory (since June 2020)</li> <li>- 1-year education (during school time) and practical experience as a mediator</li> <li>- organisation of the Jaksch/Mekhov group seminar for about two years</li> </ul>
LANGUAGES	German (mother tongue), English (advanced), French (basic knowledge)
COMPUTER SKILLS	Python, Mathematica, Open Office, Latex, usage of computing clusters