

Timon Emken

Theoretical physicist

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Current position

2019– **Postdoctoral researcher**, Chalmers University of Technology, Göteborg, Sweden

Academic education

- 2019 **Ph.D.** (Physics) University of Southern Denmark, Odense, Denmark
Specialization: Theoretical Astroparticle Physics
- 2013 **M.Sc.** (Physics) Georg August University, Göttingen, Germany
Specialization: Theoretical Particle Physics
- 2011 **B.Sc.** (Physics) Georg August University, Göttingen, Germany

Research experience

- 03/2019– **Postdoc** Department of Physics, Chalmers University of Technology, Göteborg, Sweden
Group leader: Riccardo Catena
- 02–04/2018 **Visiting researcher** C.N. Yang Institute for Theoretical Physics, Stony Brook, NY, USA
Host: Rouven Essig
- 2016–2019 **PhD student** Center for Cosmology and Particle Physics Phenomenology (CP³-Origins), Odense
Supervisor: Chris Kouvaris
Thesis: *Dark Matter in the Earth and the Sun – Simulating underground scatterings for the direct detection of low-mass dark matter*
- 2014/15 **PhD student** Faculty for Physics and Astronomy, Würzburg
Supervisor: Werner Porod
Topic: *Astrophysical Constraints on supersymmetric Pati-Salam models*
- 2012/13 **Master student** Institute for Theoretical Physics, Göttingen, Germany
Supervisor: Laura Covi & Riccardo Catena
Thesis: *Supergravity & Supernovae – Gravitino Phenomenology in Astrophysics*
Results were published in [10].
- 2011 **Bachelor student** Max Planck Institute for Dynamics and Self-Organization, Göttingen, Germany
Supervisor: Folkert Müller-Hoissen
Thesis: *Static, axially symmetric Deformations of the Schwarzschild spacetime*
- 2010 **Research intern** Institute of Materials Physics at the German Aerospace Center, Köln, Germany
Supervisor: Matthias Sperl

Scientific publications [\(Link to inSPIRE-HEP author profile\)](#)

- [1] Bradley J. Kavanagh, **Timon Emken**, and Riccardo Catena. Measuring the local Dark Matter density in the laboratory. 2020. [arXiv:2004.01621].
- [2] Riccardo Catena, **Timon Emken**, and Julia Ravanis. Rejecting the Majorana nature of dark matter with electron scattering experiments. *Journal for Cosmology and Astroparticle Physics.*, 2020(06):056, 2020. [arXiv:2003.04039].
- [3] Erik Andersson, Alex Böckmark, Riccardo Catena, **Timon Emken**, Henrik Klein Moberg, and Emil Åstrand. Projected sensitivity to sub-GeV dark matter of next-generation semiconductor detectors. *Journal for Cosmology and Astroparticle Physics.*, 2020(05):036, 2020. [arXiv:2001.08910].
- [4] Riccardo Catena, **Timon Emken**, Nicola Spaldin, and Walter Tarantino. Atomic responses to general dark matter-electron interactions. *Physical Review Research*, 2:033195, 2020. [arXiv:1912.08204].
- [5] **Timon Emken**, Rouven Essig, Chris Kouvaris, and Mukul Sholapurkar. Direct Detection of Strongly Interacting Sub-GeV Dark Matter via Electron Recoils. *Journal for Cosmology and Astroparticle Physics.*, 1909(09):070, 2019. [arXiv:1905.06348].

- [6] **Timon Emken** and Chris Kouvaris. How blind are underground and surface detectors to strongly interacting Dark Matter? *Physical Review D*, 97(11):115047, 2018. [arXiv:1802.04764].
- [7] **Timon Emken**, Chris Kouvaris, and Niklas Grønlund Nielsen. The Sun as a sub-GeV Dark Matter Accelerator. *Physical Review D*, 97(6):063007, 2018. [arXiv:1709.06573].
- [8] **Timon Emken** and Chris Kouvaris. DaMaSCUS: The Impact of Underground Scatterings on Direct Detection of Light Dark Matter. *Journal for Cosmology and Astroparticle Physics.*, 1710(10):031, 2017. [arXiv:1706.02249].
- [9] **Timon Emken**, Chris Kouvaris, and Ian M. Shoemaker. Terrestrial effects on dark matter-electron scattering experiments. *Physical Review D*, 96(1):015018, 2017. [arXiv:1702.07750].
- [10] Riccardo Catena, Laura Covi, and **Timon Emken**. Model independent limits on an ultralight gravitino from supernovae. *Physical Review D*, 91:123524, 2015. [arXiv:1410.0314].

Teaching and supervising experience

2020–	Assistant/Co-supervisor	Chalmers University of Technology, Göteborg, Sweden Einar Urdshals (PhD student) Joakim Hagel (Master student) Oskar Lindroos (Master student) Bachelor project	(2020–) (spring term 2020) (spring term 2020) (spring term 2020)
2017	Substitute lecturer	Department for Physics, Chemistry and Pharmacy, Odense, Denmark <i>Advanced Quantum Mechanics</i> <i>Introduction to Astrophysics and Cosmology</i>	(winter term 2017) (winter term 2017)
2016–	Teaching assistant	Department for Physics, Chemistry and Pharmacy, Odense, Denmark <i>Advanced Quantum Mechanics</i> <i>Introduction to Astrophysics and Cosmology</i> <i>Physics A</i> <i>Advanced Quantum Mechanics</i> <i>General Relativity and Cosmology</i>	(winter term 2017) (winter term 2017) (spring term 2017) (winter term 2016) (summer term 2016)
2014	Teaching assistant	Faculty for Physics and Cosmology, Würzburg, Germany <i>Theoretical Mechanics and Quantum Mechanics</i>	(summer term 2014)
2011–13	Teaching assistant	Institute for Theoretical Physics, Göttingen, Germany <i>Quantum Mechanics I</i> <i>Analytical Mechanics</i> <i>Mathematics for Physics I</i> <i>Analytical Mechanics</i> <i>Classical Electrodynamics</i>	(summer term 2013) (winter term 2012) (summer term 2012) (winter term 2011) (summer term 2011)

IT skills

Code C++, Python, HPC, Mathematica, CMake, MPI, git, LaTeX
OS macOS, Linux, Windows

Conference and seminar talks

15.01.2020	Direct Detection of sub-GeV Dark Matter with General Electron Interactions	Theory Seminar	Chalmers Göteborg, Sweden
03.12.2019	How atoms respond to general Dark Matter-electron interactions	QM4DM Workshop	Nordita Stockholm, Sweden
31.10.2019	Detecting low-mass Dark Matter after Scatterings in the Earth and Sun	LNGS Seminar (Invited talk)	INFN-LNGS L'Aquila, Italy
30.10.2019	How sensitive are direct detection experiments to strongly interacting light Dark Matter?	CRESST meeting (Invited talk)	Santo Stefano di Sessanio, Italy
09.10.2019	Direct Detection and Solar Reflection of sub-GeV Dark Matter	Theory Seminar (Invited talk)	University of Oslo, Norway
02.10.2019	Direct Detection of sub-GeV Dark Matter with strong Matter Interactions	Partikeldagarna 2019 Seminar for	Linköping, Sweden
26.09.2019	Direct Detection of sub-GeV Dark Matter with strong Matter Interactions	Frank Wilczek's visit	Göteborg, Sweden
18.09.2019	How Scatterings affect the Dark Matter Velocity Distribution in the Laboratory	Autumn Institute 2019 (Invited talk)	INFN-LNF, Frascati, Italy
12.08.2019	Direct detection of sub-GeV dark matter with strong interactions through a light mediator	Light Dark World 2019 (Invited talk)	ESI Vienna, Austria
16.04.2019	Detecting dark matter after scatterings inside the Earth or Sun	TSP seminar	Göteborg, Sweden
28.02.2019	Simulating Dark Matter in the Earth and the Sun	PhD defence	Odense, Denmark
01.06.2018	How sensitive are direct detection experiments to strongly interacting dark matter?	MASS2018,	Odense, Denmark
24.04.2018	The Impact of Earth Scatterings on Light Dark Matter Detection	C.N. YITP,	Stony Brook, USA
29.08.2017	Terrestrial Effects on Light Dark Matter Detection,	DaVCo 2017,	Odense, Denmark
14.07.2016	Simulating Dark Matter Trajectories for Direct Detection Experiments	DTP 2016,	ECT*, Trento, Italy
28.11.2013	Supergravity & Supernovae,	GRK1147 seminar,	Würzburg, Germany
06.11.2013	Gravitino Phenomenology with Supernovae,	Cosmology seminar,	Göttingen, Germany
17.09.2013	Gravitino Phenomenology with Supernovae,	Theory seminar,	Würzburg, Germany
08.07.2013	Gravitino Phenomenology in Astrophysics,	IMPRS Workshop,	MPI, München, Germany

Outreach

2017	Contributing author	Quantum rascals web portal <i>Kvantebanditter</i>
2017	Features in the media	Interviews and popular scientific articles about my research, e.g. in New Scientist.
2017	Outreach article	"Detecting Dark Matter and Seeing the Invisible" for student newspaper <i>Hjerneblod</i> .

Workshops

2019	Workshop	STRONG-DM,	ESI, Vienna, Austria
2017	Workshop	Code Refinery,	NeIC, Aarhus, Denmark
2017	Winter School	9th Odense Winter School on Theoretical Physics,	CP ³ -Origins, Odense, Denmark
2016	Summer School	Doctoral Training Program,	ECT*, Trento, Italy
2014	Workshop	DESY theory workshop,	DESY, Hamburg, Germany
2014	Workshop	Terascale C++ School,	DESY, Hamburg, Germany
2013	Summer School	Summer School on Particle Physics,	ICTP, Trieste, Italy
2013	Spring School	Computer Algebra in Particle Physics,	DESY, Zeuthen, Germany

Language skills

German	native speaker	English	fluent
Danish	proficient	Japanese	basic

Various

- 2018- **Referee** Physical Review D (PRD), Journal for Cosmology and Astroparticle Physics (JCAP)
- 2019- **Referee** European Physical Journal C (EPJC)
- 2019 **Organizer** Quantum Materials for Dark Matter Detection (QM4DM) Workshop