Curriculum Vitae

Name: Natalia Chepiga
Nationality: Ukrainian
Place of birth: Kharkiv, Ukraine
Date of birth: December 27, 1988
Marital status: married
Address: Department of Quantum Nanoscience,
Kavli Institute of Nanoscience,
Faculty of Applied Sciences,
Lorentzweg 1, 2628 CJ
Delft, The Netherlands
E-mail: n.chepiga@tudelft.nl
natalia.chepiga@alumni.epfl.ch
ORCID: 0000-0002-5313-5035
Languages: Russian, English, Ukrainian (all fluent),
French(B1), Dutch(B1), German(A2)

Expertise:

Condensed matter physics, quantum many-body physics and strongly correlated systems, computational physics and algorithm development (Tensor Networks, Density Matrix Renormalization Group algorithm, Exact Diagonalization), quantum phase transitions, conformal field theory, chiral melting, Rydberg atoms and other systems with constrained Hilbert space (non-abelian anyons, quantum dimers and quantum loops, supersymmetric models), quantum magnetism, low-dimensional quantum systems, topologically ordered states, systems with multi-component Hilbert space

Education:

04/13 – 04/17 Docteur ès sciences, Institute of Physics, École Polytechnique Fédérale de Lausanne,
Supervisor: prof. Frédéric Mila
Thesis Title: ***Dimerization and exotic criticality in spin-S chains***
Private defense: 21/02/2017; Public defense: 23/03/2017
Distinction from Doctoral School of Physics, EPFL

08/11 – 02/13 Master in Physics, École Polytechnique Fédérale de Lausanne,
Supervisor: prof. Frédéric Mila
Thesis Title: ***Topological phase transitions in spin ladders***

09/07 – 07/11 BSc in Applied Physics with First Class Honors, V.N.Karazin Kharkiv National University, Department of Theoretical Nuclear Physics
Supervisor: Sergey I. Shevchenko
Thesis Title: **Description of the e*lectrons-holes superfluidity in terms of the order parameter***

09/00 – 06/07 High School Certificate with First Class Honors

Employment:

01/21- **Assistant professor** at the department of Quantum Nanoscience, the faculty of Applied

Sciences, TU Delft, Netherlands

01/19-12/20 **Postdoc** in the group of **prof. P.Corboz** at the University of Amsterdam, Netherlands. The work has been supported by the Swiss National Science Foundation (grant number P400P2_183847) and by prof. Corboz's funds.

05/17-12/18 **Postdoc** in the group of **prof. S.R. White** at the University of California, Irvine, USA. The work has been supported by the Swiss National Science Foundation (grant number P2ELP2_172271) and by prof. White's funds.

04/13 – 04/17 **Doctoral assistant** at the Chair of condensed matter theory, Institute of Physics, École Polytechnique Fédérale de Lausanne, Supervisor: prof. Frédéric Mila

Publications:

17. **Natalia Chepiga** and Frédéric Mila,
Kibble-Zurek exponent and chiral transition of the period-4 phase of Rydberg chains
Nature Communications, **12**, 414 (2021)

16. Mario Motta, Claudio Genovese, Fengjie Ma, Zhi-Hao Cui, Randy Sawaya, Garnet Kin-Lic Chan, **Natalia Chepiga,** Phillip Helms, Carlos Jimenez-Hoyos, Andrew J. Millis, Ushnish Ray, Enrico Ronca, Hao Shi, Sandro Sorella, Edwin M. Stoudenmire, Steven R. White, Shiwei Zhang (Simons collaboration on the many-electron problem)
Ground-state properties of the Hydrogen chain: insulator-to-metal transition, dimerization, and magnetic phases
Phys. Rev. X **10**, 031058 (2020)

15. **Natalia Chepiga**, Steven R. White,
Critical properties of a comb lattice
SciPost Phys. **9**, 013 (2020)

14. **Natalia Chepiga**, Ian Affleck, and Frédéric Mila,
Floating, critical, and dimerized phases in a frustrated spin-3/2 chain
Phys. Rev. B **101**, 174407 (2020)

13. Laurens Vanderstraeten, Elisabeth Wybo, **Natalia Chepiga,** Frank Verstraete, and Frédéric Mila,
Spinon confinement and deconfinment in a spin-1 chain
Phys. Rev. B **101**, 115138 (2020);

12. **Natalia Chepiga** and Frédéric Mila,
Dimerization and effective decoupling in two spin-1 generalizations of the spin-1/2 Majumdar-Ghosh chain
Phys. Rev. B **100**, 104426 (2019)*;*

11. **Natalia Chepiga** and Steven R. White,
Comb tensor networks
Phys. Rev. B **99**, 235426 (2019)

10. **Natalia Chepiga** and Frédéric Mila,
DMRG investigation of constrained models: from quantum dimer and quantum loop ladders to hard-boson and Fibonacci anyon chains
SciPost Phys. **6**, *033 (2019);*

9. **Natalia Chepiga** and Frédéric Mila,
Floating phase versus chiral transition in a 1D hard-boson model
Phys. Rev. Lett. **122**, 017205 (2019)

8. **Natalia Chepiga** and Frédéric Mila,
Rigorous decoupling between edge states in frustrated spin chains and ladders
Phys. Rev. B **97**, 174434 (2018)

7. **Natalia Chepiga** and Frédéric Mila,
Exact zero modes in frustrated Haldane chain
Phys. Rev. B **96**, 060409 (2017), Rapid Communication

6. **Natalia Chepiga** and Frédéric Mila,
Excitation spectrum and Density Matrix Renormalization Group iterations
Phys. Rev. B **96**, 054425 (2017)

5. L.Wang, **N.Chepiga**, D.-K.Ki, L.Li, F.Li, W.Zhu, Y.Kato, O.S.Ovchinnikova, F.Mila, I.Martin, D.Mandrus, A.F.Morpurgo,
Controling the topological sectors of magnetic solitons in exfoliated $Cr_{1/3}NbS_2$ crystals
Phys. Rev. Lett. **118**, 257203 (2017), Editor's Suggestion

4. **Natalia Chepiga**, Ian Affleck, and Frédéric Mila,
Spontaneous dimerization, critical lines, and short-range correlations in a frustrated spin-1 chain
Phys. Rev. B **94**, 205112 (2016)

3. **Natalia Chepiga**, Ian Affleck, and Frédéric Mila,
Comment on "Frustration and Multicriticality in the Antiferromagnetic Spin-1 Chain"
Phys. Rev. B **94**, 136401 (2016)

2. **Natalia Chepiga**, Ian Affleck, and Frédéric Mila,
Dimerization transitions in spin-1 chains
Phys. Rev. B **93**, 241108 (2016), Rapid Communication

1. **Natalia Chepiga**, Frédéric Michaud, and Frédéric Mila,
Berry phase investigation of spin-S ladders
Phys. Rev. B **88**, 184418 (2013)

Pre-prints:

1. **Natalia Chepiga** and Frédéric Mila,
Lifshitz point at commensurate melting of 1D Rydberg atoms
arXiv:2101.00999

Invited talks:

02/21 Entanglement in Strongly Correlated Systems, Benasque, Spain,
12/20 European Tensor Network online series, *Chiral transitions in chains of Rydberg atoms*
11/19 Delta-ITP triangle meetings: Quantum and Topological Matter, University of Utrecht, The Netherlands, *Comb tensor networks*
07/19 Computational Approaches to Quantum Many-body Problems, ISSP, Kashiwa, Japan, *Practical introduction to MPS + Comb tensor networks + DMRG for constrained models (in total: 3 hours of lectures)*
03/19 DPG Frühjahrstagung 2019, Regensburg, Germany, *DMRG investigation of constrained models: from quantum dimer and quantum loop ladders to hard-boson and Fibonacci anyon chains*
02/19 Constrained Many-body Dynamics, MPI PKS, Dresden, Germany, *DMRG investigation of constrained models: from quantum dimer and quantum loop ladders to hard-boson and Fibonacci anyon chains*
06/18 TOPMAT, Paris-Saclay, France, *DMRG investigation of quantum dimer ladders*

Contributed talks:

01/21 Waiting for Highly Frustrated Magnetism 2021, Dresden, Germany, *Floating, critical and dimerized phases in a frustrated spin-3/2 chain*
12/20 Exploring quantum many-body physics with ultra-cold atoms and molecules, Bad Honnef, Germany, *Kibble-Zurek exponent and chiral transition of the period-4 phase of Rydberg chains*
02/20 Entanglement in Strongly Correlated Systems, Benasque, Spain, *Ashkin-Teller transition of Rydberg atoms with two-site blockade*
01/20 Physics@Veldhoven 2020, Veldhoven, The Netherlands, *Simulating constrained models with tensor networks*
09/19 Korrelationstage 2019, Dresden, Germany, *Comb tensor networks*
10/18 Topological phases in condensed matter and cold atom systems, Cargese, Corsica, France *Constrained DMRG as a byway to investigate critical properties of frustrated magnets*
06/18 Trends in quantum magnetism, Bad Honnef, Germany, *DMRG investigation of quantum dimer ladders*
02/18 Entanglement in Strongly Correlated Systems, Benasque, Spain, *DMRG investigation of quantum dimer ladders*
11/17 Novel Quantum States in Condensed Matter 2017, Kyoto, Japan, *Spontaneous dimerization, critical lines, and exact zero modes in a frustrated spin-1 chain*
06/17 Many Electron Collaboration Summer School, Stony Brook, USA, *Excitation spectrum and Density Matrix Renormalization Group iterations*
02/17 Entanglement if strongly correlated systems, Benasque, Spain, *Dimerization and exotic criticality in spin-S chains*
09/16 Recent Progress in Low-Dimensional Quantum Magnetism, Lausanne, Switzerland, C*ritical lines and short-range correlations in a frustrated spin-1 chain*
07/16 Swiss Physical Society Meeting, Lugano, Switzerland, *Dimerization transitions in spin-1 chains*
07/16 Swiss Workshop on Materials with Novel Electronic Properties 2016, Les Diablerets,

Switzerland, *Dimerization transitions in spin-1 chains*

05/16 Japan-Swiss Workshop 'Trends in Theory of Correlated Materials', PSI, Villigen, Switzerland, *Dimerization transitions in spin-1 chains*

10/14 Japan-Swiss Workshop 'Trends in Theory of Correlated Materials', Tokyo, Japan, *Berry phase investigation of spin-S ladders*

07/14 Swiss Physical Society Annual Meeting, Fribourg, Switzerland, *Berry phase investigation of spin-S ladders*

Seminars:

12/20 University of Amsterdam, The Netherlands; host: **P.R.Corboz**, *Constrained tensor networks: a new approach to quantum criticality*

02/20 TU Delft, The Netherlands; *Tensor network investigation of constrained models: from quantum dimer and quantum loop ladders to chains of Rydberg bosons*

06/19 University of Nottingham, UK; host: **Juan P. Garrahan**, *Constrained DMRG as a byway to investigate critical properties of frustrated magnets*

02/19 University of Amsterdam, The Netherlands; host: **P.R.Corboz**, *Floating phase versus chiral transition in constrained models*

10/18 University of California, Irvine, USA; host: **Steven R.White**, *Floating phase versus chiral transition in constrained models: from hard-boson chain to quantum dimer and quantum loop ladders*

03/18 HISKP, Universität Bonn, Germany; host: **Corinna Kollath**, D*MRG investigation of quantum dimer ladders*

02/18 Max-Planck-Harvard Institute for Quantum Optics, Garching, Germany; host: **Ignacio Cirac**, *Frustrated spin chains: exotic criticality, exact zero modes and quantum dimer model.*

11/17 Perimeter Institute, Waterloo, Canada; host: **Guifre Vidal**, *Spontaneous dimerization, critical lines and exact zero modes in frustrated spin-1 chain.*

10/17 University of British Columbia, host: **Ian Affleck**, *Exact zero modes in frustrated spin chains*

Poster presentations:

10/18 Topological phases in condensed matter and cold atom systems, Cargese, Corsica, France, *A comb tensor network*

09/17 Korrelationstage 2017, Dresden, Germany, *Dimerization and exotic criticality in spin-S chains*

09/16 8th International Conference on Highly Frustrated Magnetism, Taipei, Taiwan, *Dimerization transitions in spin-1 chains*

01/15 Theory Winter School on New Trends in Frustrated Magnetism, Tallahassee, Florida, USA, *Frustration and spontaneous dimerization in spin-1 chain*

10/13 School on Advanced Algorithms for Correlated Quantum Matter, Würzburg, Germany, *Berry phase investigation of spin-S ladders*

07/13 Swiss Workshop on Materials with Novel Electronic Properties, Les Diablerets, Switzerland, *Berry phase investigation of frustrated quantum magnets*

Grants:

02/19-09/20 PostdocMobility by the Swiss National Science Foundation, University of Amsterdam, The Netherlands. Project title: Further development of infinite Projected Entangled Pair States (iPEPS): network of clusters and hard constraints

04/17-09/18 EarlyPostdocMobility by the Swiss National Science Foundation, University of California, Irvine, USA. Project title: **Efficient Density Matrix Renormalization Group (DMRG) algorithm for two-dimensional systems and its applications.**

Reviewing activities:
Physical Review Letters, Physical Review Research, Physical Review B, SciPost, New Journal of Physics

Member of a committee:
01/20 Poster prize committee member at Physics@Veldhoven 2020, Veldhoven, The Netherlands

Postdoc mobility fellow of the Swiss National Science Foundation

Selected Awards:

12/17	Distinction from Doctoral School of Physics, EPFL for the thesis *Dimerization and exotic criticality in spin-S chains*
10/11 – 02/13	Excellence scholarship provided by École Polytechnique Fédérale de Lausanne
09/07 – 06/11	Government scholarships for university students with outstanding results
09/03 – 08/08	President of Ukraine Scholarship; Kharkiv City Mayor Scholarship
09/03 – 06/11	Several diploma including 2nd prize (university) and 1st prize (high school) in Olympiads in Physics; 1st prize in Ukrainian Competition of Research projects

Teaching experience:

09/14 – 01/17	Teaching Assistant in '**Physique Statistique I**' at EPFL
02/16 – 06/16	Teaching Assistant in '**Mathematical Methods for Physicists**' at EPFL
02/15 – 06/15	Teaching Assistant in '**Physique Statistique II**' at EPFL
09/13 – 12/13	Teaching Assistant in '**Statistiques et probabilités**' at EPFL
11/07 – 06/11	High School Teacher in Advanced Physics and Mathematics at Private Boiko School, Ukraine
08/08 – 08/09	Summer School Teacher for Granted Youth (supported by Kharkov City Council)

Outreach:

Public lectures at “The day of science”(2016) and “The night of science”(2018) at Private Boiko school, Ukraine. AskMeAnything session (2017, 2020) at Private Boiko school, Ukraine.

Volunteer projects:

07/10 Camp leader in the international volunteer project, Lyubotin, Kharkiv district, Ukraine

08/10 Environmental volunteer program in Vichy, France
08/09 Volunteer in Summer Camp in Spangenberg, Germany
11/07 Team leader in Ukraine-China exchange program in Shitzyatjuan, China

References:

1. Prof. Frédéric Mila, École Polytechnique Fédérale de Lausanne, frederic.mila@epfl.ch

2. Prof. Philippe Corboz, University of Amsterdam, P.R.Corboz@uva.nl

3. Prof. Ian Affleck, University of British Columbia, iaffleck@phas.ubc.ca

4. Prof. Steven R. White, University of California, Irvine, srwhite@uci.edu

5. Prof. Kareljan Schoutens, University of Amsterdam, c.j.m.schoutens@uva.nl