Boris Ponsioen

Nationality: Dutch
Place of origin: Haarlem, Netherlands

Universiteit van Amsterdam
Institute for Theoretical Physics

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Professional

Fermioniq
Chief Scientific Officer, 2023-
Lead on classical emulation of quantum circuits
using tensor networks

Universiteit van Amsterdam
Postdoctoral research in condensed matter theory, 2022-
Specialization: development of numerical optimization methods
based on tensor networks and automatic differentiation, applied
to condensed matter quantum physics

Fermioniq
Senior researcher, 2022-2023
Developer and researcher on emulation of quantum software
using tensor networks

Education

Universiteit van Amsterdam
Ph.D. Theoretical Physics, 2022
Thesis topics: condensed matter theory, tensor networks, PEPS
Supervisor: Philippe Corboz

Universiteit van Amsterdam
MSc. Physics, 2017
Theoretical Physics (GPA 8.3)
Thesis topic: tensor networks, numerical many-body techniques,
condensed matter theory
Supervisor: Philippe Corboz

Universiteit van Amsterdam
BSc. Physics and Astronomy, 2014
Thesis topic: automatic artery recognition in CT scans,
dynamical blood flow analysis

In addition obtained 57 ECTS towards a Bachelor's
degree in Medicine, 2013-2015

Gymnasium Felisenum
High school (VWO/Gymnasium)
Cum laude, 2004-2010

Expertise

– Algorithms for simulating quantum many-body systems,
in particular 2D **tensor networks**, variational optimization techniques,
automatic differentiation and large-scale parallelization
using **Python**, **Matlab** and **C / C++**
– Condensed matter theory & computational physics
Specific interests: strongly correlated systems, superconductivity,
frustrated magnets, ground states & quasiparticle excitations
and novel numerical algorithm development
– Extensive experience in building database-driven (web)applications,
using **Ruby** and **Python**

Publications

[7] Y. Xu, J. Hasik, B. Ponsioen and A.H. Nevidomskyy, *Simulating spin Dynamics of Supersolid States in a Quantum Ising Magnet*, arXiv:2405.05151 (2024)
[7] B. Ponsioen, J. Hasik and P. Corboz, *Improved summations of n-point correlation functions of projected entangled-pair states*, Physical Review B 108 (19), 195111 (2023)
[6] B. Ponsioen, S. S. Chung and P. Corboz, *Superconducting stripes in the hole-doped three-band Hubbard model*, Physical Review B 108 (20), 205154 (2023)
[5] M. Peschke, B. Ponsioen and P. Corboz, *Competing States in the Two-Dimensional Frustrated Kondo-Necklace Model*, Physical Review B **106** (20), 205140 (2022)
[4] L Vanderstraeten et al., *Variational methods for contracting projected entangled-pair states*, Phys. Rev. B **105**(19), 195140 (2022)
[3] B. Ponsioen and P. Corboz, *Automatic differentiation applied to excitations with projected entangled pair states*, SciPost Physics **12**, 006 (2022)
[2] B. Ponsioen and P. Corboz, *Excitations with projected entangled pair states using the corner transfer matrix method*, Phys. Rev. B **101**(19), 195109 (2020)
[1] B. Ponsioen, S. S. Chung and P. Corboz, *Period 4 stripe in the extended two-dimensional Hubbard model*, Phys. Rev. B **100**(19), 195141 (2019)

Extracurricular

Cofounder Rubyprog
Activities include outreach projects to high school students with programming courses and development of medium-scale webapplications, 2013-2018

SciPost
Member development team, led by prof. J.-S. Caux, 2016-2019

Year Representation Committee Medicine Studies
Chairman, 2013-2014

ShoSho Amsterdam
Visual effects artist (film and games), 2010 & 2013

Teaching

Universiteit van Amsterdam
Teaching assistant in following MSc.-level courses:
– Statistical physics and condensed matter theory I, 2018, 2019
– Advanced numerical methods, 2018
– Advanced statistics, 2018, 2019

Organized courses:
– Summerschool Programming, UvA 2014 & 2015
– Introduction courses programming in Ruby,
Gymnasium Felisenum, Barlaeus Gymnasium,
2013-2014 (3 courses total)

Talks / posters

IQTN meeting, New York 2023, poster
ITAMP workshop Harvard, Cambridge 2022
Entanglement scaling workshop EPFL, Lausanne 2022, poster
Automatic Differentiation applied to excitations with PEPS

SCES 2022 conference, Amsterdam, contributed talk
Charge excitations of the 2D Hubbard model with PEPS, powered by Automatic Differentiation, 27 July 2022

Physics @ Veldhoven conference 2021, contributed talk
Excitations with projected entangled pair states, 18 Jan 2021

Physics @ Veldhoven 2020 conference, poster
Excitations with iPEPS using the CTM method, 21 Jan 2020

Ghent University, invited seminar
Excitations in iPEPS with CTM, 20 Dec 2019

University of Amsterdam, invited seminar
Excitations in iPEPS, 9 Oct 2019

Entanglement in Str. Corr. Sys. conference, Benasque, poster

Ground state phase diagram of the 2D Hubbard model with next-nearest neighbour hopping, Feb/Mar 2019

Physics @ Veldhoven 2019, poster
Ground state phase diagram of the 2D Hubbard model with next-nearest neighbour hopping, 22 Jan 2019

European Tensor Network PhD School, Ghent, poster
Combining Variational Optimization with Entanglement Renormalization in a Tensor Network framework, Oct 2017

ETH Zurich, seminar
Combining Variational Optimization with Entanglement Renormalization in a Tensor Network framework, May 2017

Languages

Dutch (native), English (fluent),
French (conversational), German (conversational), Finnish (basic)