Smoothly breaking unitarity : studying spontaneous collapse using two entangled, tuneable, coherent amplifiers

Reep, T.H.A. van der

Cover Page

Universiteit Leiden

The handle http://hdl.handle.net/1887/73911 holds various files of this Leiden University dissertation.

Author: Reep T.H.A. van der
Title: Smoothly breaking unitarity : studying spontaneous collapse using two entangled, tuneable, coherent amplifiers
Issue Date: 2019-06-13

Curriculum vitae

Thomas Hendrik Abraham (Tom) van der Reep was born on 25 October 1989 in Rotterdam, where he also grew up. After graduating from the Marnix Gymnasium in Rotterdam in 2008, he started his studies in Aerospace Engineering at Delft University of Technology. He obtained his BSc-degree *cum laude* after a feasibility study for an asteroid sample-return mission, performed with a group of 9 other students under supervision of Ir. R. Noomen.

Following this, Tom switched his field of studies towards Physics, in which he obtained a BSc-degree *cum laude* at Leiden University. During his studies, he worked under supervision of Prof. dr. J. Aarts and Prof. dr. ir. S.J. van der Molen on the question whether a study of magnetic phenomena using a low-energy electron microscope could be a fruitful endeavour. During this research project, he used magnetic vortex disks as a specific physical system.

Continuing his studies in Physics, Tom enrolled in the MSc-programme at Leiden university, in which he followed the CASIMIR PRE-PHD-track. During his MSc-studies, he performed three research projects. First, he worked under supervision of Dr. D.F.E. Samtleben at Nikhef on the expected distinguishability of shower-like and track-like events within the ORCA experiment, a study which was necessary in view of a proposed experiment to shed light on the neutrino mass hierarchy. Secondly, Tom worked under supervision of Dr. M. Blaauwboer at Delft University of Technology, performing a theoretical study into the effects of noise in reference-frame-independent quantum key distribution, in light of eavesdropping. Finally, he worked under supervision of Prof. dr. ir. T.H. Oosterkamp on the skating project, which aims to measure the thickness of the water layer that supposedly forms while an ice skate slides over a layer of ice.

Tom completed his MSc-studies *cum laude* in 2014 by writing a PhD-research proposal. After the proposal was granted, he pursued a PhD under supervision of Prof. dr. ir. T.H. Oosterkamp. During his PhD, he made the initial steps towards an experiment that aims to entangle two parametric amplifiers in order to study whether such amplifiers could give rise to spontaneous wavefunction collapse – in other words, whether such amplifiers turn into detectors at a large gain. He worked on the development of travelling-wave parametric amplifiers using Josephson junctions and built a microwave set-up to characterise the devices. The former work was done at Delft University of Technology in close

collaboration with Dr. A. Bruno and Prof. dr. L. DiCarlo. Furthermore, Tom worked on the quantum description of travelling-wave parametric amplifiers and on the theoretical description and expected output of the proposed experiment, specifically in the presence of quantum state collapse.

In his spare time, Tom enjoys singing, hiking, reading and riding his bicycle.

List of publications

1. T.H.A. van der Reep. A mesoscopic Hamiltonian for Josephson travelling-wave parametric amplifiers. *Submitted*, arXiv:1812.05907 (2018).

2. T.H.A. van der Reep, L. Rademaker, X.G.A. Le Large, R.H. Guis, T.H. Oosterkamp. An experimental proposal to study spontaneous collapse of the wave function using two travelling-wave parametric amplifiers. *Submitted*, arXiv:1811.01698 (2018).

3. L. Rademaker, T. van der Reep, N. Van den Broeck, B. van Waarde, M. de Voogd, T. Oosterkamp. The instability of a quantum superposition of time dilations. arXiv:1410.2303 (2014).