

# KEVIN THIEME

Postdoctoral Researcher in Experimental Astroparticle Physics

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## POSTDOCTORAL APPOINTMENT

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JAN. 2022 – TODAY **Postdoctoral Research Fellow**, UNIVERSITY OF HAWAII AT MĀNOA, DEPARTMENT OF PHYSICS AND ASTRONOMY, USA  
High-Energy Physics Group of JELENA MARICIC  
Deputy manager of Underground Argon Cryogenics of DarkSide-20k experiment, co-leading with GUILLAUME PLANTE (COLUMBIA UNIVERSITY)

## EDUCATION

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NOV. 2017 – DEC. 2021 **Dr. sc. nat.**, UNIVERSITY OF ZURICH, DEPARTMENT OF PHYSICS, CH  
*PhD thesis: The Low-Energy and Large-Scale Frontier of Dual-Phase Xenon Time Projection Chambers for Dark Matter Search*  
Advisor and committee chair: LAURA BAUDIS  
Committee: PATRICIA SÁNCHEZ-LUCAS, MARC SCHUMANN, NICOLA SERRA  
Honoured with distinction by the Faculty of Science

SEP. 2015 – JUN. 2017 **MSc. ETH Physics**, ETH ZURICH, DEPARTMENT OF PHYSICS, CH  
Master thesis: *Null Lagrangians and Noether's theorem for non-local field theories*  
Advisors: NIKLAS BEISERT, DANIELE ORITI, ALEXANDER KEGELES

SEP. 2012 – SEP. 2015 **BSc. ETH Physics**, ETH ZURICH, DEPARTMENT OF PHYSICS, CH  
Semester thesis: *Vibration measurement at the PSI nEDM-experiment*  
Advisors: KLAUS STEFAN KIRCH, SYBILLE KOMPOSCH, JOCHEN KREMPPEL

JUN. 2012 **University entrance diploma**, GYMNASIUM COSWIG, GER  
Honoured with distinction by the Saxon Minister of Education

## RESEARCH STAYS

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JAN. 2022 – TODAY Stationed at EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN), CH  
Associated Member (Neutrino Platform), RE37 and NP04 experiments

JAN. 2020 InvisiblesPlus Secondment at COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK,  
DEPARTMENT OF PHYSICS, USA  
Group of ELENA APRILE

SEP. 2016 – APR. 2017 Master project at MAX PLANCK INSTITUTE FOR GRAVITATIONAL PHYSICS (AEI  
POTSDAM), GER  
Division Quantum Gravity and Unified Theories, group for Microscopic Quantum  
Structure and Dynamics of Spacetime

FEB. 2015 – JUN. 2015 Semester project at PAUL SCHERRER INSTITUTE (PSI), CH  
Division Research with Neutrons and Muons, group for Ultra Cold Neutron Physics

## RESEARCH EXPERIENCE

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### POSTDOCTORAL PROJECTS

As a member of the [DARKSIDE-20K COLLABORATION](#) I play a substantial role in advancing the development of a next-generation dark matter detector which will deploy  $\sim 50$  t of low-radioactivity liquid argon as active target in a dual-phase time projection chamber (TPC). As deputy manager of the Underground Argon Cryogenics System, I am responsible for its benchmarking and preparation for a mock-up detector test at INFN LNGS and co-lead the

design and planning process for its integration in DarkSide-20k. I am further involved in the design and simulation efforts for the DarkSide-20k inner detector.

#### UNDERGROUND ARGON CRYOGENICS OF DARKSIDE-20K

- Lead of the installation and benchmarking of the cryogenics system for mock-up test at LNGS
- Major involvement in the commissioning of the cryogenics system (RE37) at CERN
- System design: operating modes, functional logic, piping & instrumentation diagram

#### INNER DETECTOR OF DARKSIDE-20K

- Design and testing of a capacitive level meter, liquid level control system and camera assembly for use in cryogenic environments for the DarkSide-20k mock-up detector
- Responsible for gas pocket formation and monitoring system of DarkSide-20k TPC
- Flow and thermal modelling of the argon volume in the DarkSide-20k TPC with CFD software ANSYS Fluent

In addition, I am involved in R&D on PEN-based wavelength shifting reflector and in ProtoDUNE-HD (NP04) at CERN.

#### DOCTORAL PROJECTS

As a member of the [DARWIN COLLABORATION](#) and in the context of the ERC-funded project [XENOSCOPE](#), I was studying the physics of low-energy interactions in liquid xenon and conducting detector and photosensor R&D towards the next-generation dark matter observatory DARWIN, a dual-phase TPC containing 40 t of liquid xenon as active target.

#### VERTICAL DARWIN DEMONSTRATOR

- Major involvement in the development of a 2.6 m tall prototype dual-phase xenon TPC with 350 kg xenon
- Leading role in the successful commissioning phase and the first run
- Design and installation of the following subsystems: horizontal levelling system, heat exchangers, filtration and safety recuperation gas system, two independent xenon storage and recovery systems (gas and liquid), including 385 l pressure vessel with 90 bar rating
- Horizontal levelling system is a registered German utility model ([DE 20 2021 101 412 U1](#)), Swiss patent pending ([CH 718 439 A2](#))

#### MICROPHYSICS MEASUREMENTS AT LOW ENERGIES AND NOVEL PHOTOSENSORS

- Operation of the first dual-phase xenon TPC with SiPMs and characterisation with internal  $^{37}\text{Ar}$  and  $^{83\text{m}}\text{Kr}$  sources down to its energy threshold
- Measurement of the mean electronic excitation energy of liquid xenon (W-value) with calibration data and single-electron events
- Development and implementation of an efficient raw-data processing framework in C++ and ROOT for dual-phase xenon TPC with hybrid photosensor readout (SiPM/PMT)
- Design and assembly of a source insertion system for gaseous  $^{37}\text{Ar}$  into a TPC gas system and source production in collaboration with the Laboratory for Radiochemistry at SINQ (PSI)
- Optical simulations with GEANT4 and search for external double photoelectron emission in SiPMs

#### MASTER PROJECT

- Study of general aspects of covariant Loop Quantum Gravity and in particular of Group Field Theory
- Identification of equivalence class of non-local Lagrangians by the derivation of the non-local Euler-Lagrange equations and application of known local theorems, preprint (no journal submission): [arXiv:2009.13499 \(2020\)](#)
- Alternative derivation of Noether's theorem and conservation laws for non-local field theories from A. KEGELES and D. ORITI (2016), and extension by means of the found additional symmetry

## SEMESTER PROJECT

- Assessment of the influence of environmental vibration sources on an optical table for the installation of a new laser system as light source for a magnetometer operating over a long beam distance
- Development of a LabVIEW-based virtual instrument for an accelerometer for data acquisition and analysis

## TEACHING AND SUPERVISION EXPERIENCE

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- Teaching assistant for courses on experimental physics I – IV for physics majors (4 semesters)
- Assistant for laboratory courses for physics majors and veterinary medicine students (2 semesters)
- Supervisor of BSc. student STEFAN HOCHREIN (UNIVERSITY OF ZURICH): *Calibration of the first dual-phase xenon time projection chamber with silicon photomultiplier readout*, honored with University of Zurich Semester Award Autumn 2019
- Supervisor of MSc. student NICOLE SCHERMER (TECHNICAL UNIVERSITY OF MUNICH) during semester project: *Tests of low-power preamplifiers for SiPMs in cryogenic environment*
- Advised MSc. student PAOLO SALOMONE (SAPIENZA UNIVERSITY OF ROME) at CERN: *The DarkSide-20k cryogenics system test at CERN*, and during PhD at LNGS
- Advised PhD student VICTOR GOICOECHEA CASANUEVA (UNIVERSITY OF HAWAII): *Direct Dark Matter Search with the DarkSide Experiment*
- Advised undergraduate students from WILLIAMS COLLEGE during summer project at LNGS

## CONFERENCES, WORKSHOPS AND SEMINARS

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- 8 – 12 JULY 2024: IDM 2024, [Poster](#), L'Aquila, IT
- 23 – 26 MAY 2022: XESAT2022, [Talk](#), University of Coimbra, PT
- 1 FEB. 2022: XENON/DARWIN SCIENCE CLUB, *A Measurement of the Mean Electronic Excitation Energy of Liquid Xenon*, online
- 8 OCT. 2021: INPA SEMINAR (LBNL Berkeley), [Talk](#), invited, online
- 12 – 23 JUL. 2021: ICRC 2021, [Talk](#), online, proceedings: [PoS\(ICRC2021\)](#)
- 28 – 30 AUG. 2019: LIDINE 2019, [Talk](#), University of Manchester, UK
- 26 – 30 AUG. 2019: SPS-ÖPG ANNUAL MEETING, [Talk](#), University of Zurich, CH
- 10 – 17 JUL. 2019: EPS-HEP2019, [Talk](#), ICC & Ghent University, BE
- 9 – 11 JAN. 2019: ZPW2019, A NEW LOOK AT DARK MATTER, Participant, University of Zurich, CH
- 21 – 22 JUN. 2018: SENSE TECHFORUM, Poster: *Characterization of SiPMs for Use in Liquid Xenon Time Projection Chambers*, University of Geneva, CH

## IT SKILLS

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- PROGRAMMING: C/C++ (proficient), Python (proficient), LabVIEW (competent)
- ANALYSIS: ROOT (proficient)
- SIMULATION: ANSYS Fluent/Maxwell (expert), COMSOL Multiphysics AC/DC Module (proficient), GEANT4 (advanced beginner)
- CAD: SolidWorks (expert)
- TYPESETTING: LaTeX (proficient)

## LANGUAGES

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ENGLISH: Fluent      GERMAN: Mother tongue      FRENCH: Basic knowledge

## ACTIVITIES

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- Soaring since 2008 (Sailplane Pilot License in 2010), duty as flight controller on glider airfield
- Tea Sommelier (Berlin Tea Academy Certificate 2024)