

# WELCOME

TO THE

Master's programme in

# Theoretical and Computational Methods

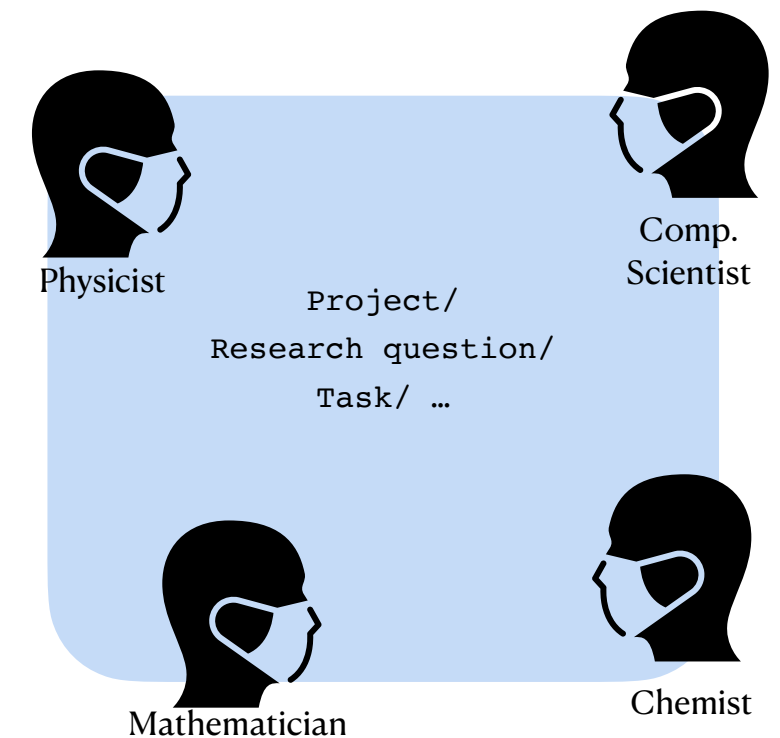
(TCM)

Orientation 1.9.2022

# Motivation

What the society needs?

- Well educated people able to solve problems
- Ethical and creative thinkers
- Project coordination skills
- Abilities to work in a team and independently



In TCM these are the "learning goals" of the entire degree.

No study lines. Lot of freedom in building the degree content.

**Study planning and academic mentoring**



# TCM personnel:

(= main contact points)

## Steering group:

### Faculty members:

Kimmo Tuominen (director);

theoretical (particle) physics

Emails: *first.last at helsinki.fi*

Kai Puolamäki (vice-director);

data science & computer science

*kimmo.i.tuominen at helsinki.fi*

Paolo Muratore-Ginanneschi ;

mathematics and statistics (+ InstituteQ)

Antti Kuronen;

materials science

Bernhardt Reischl;

atmospheric sciences

Vivek Sharma;

biophysics & chemistry

David Weir;

particle physics and cosmology

### Student members:

Ainhoa Hernandez Serrano;

### External:

Esko Keski-Vakkuri; theoretical/ mathematical physics

Ronja Öhrnberg

Jani Lukkarinen; mathematical physics

Satumaaria Sukuvaara

Sabrina Maniscalco; quantum science & technology

Lucile Turc; space physics

### Education coordinator:

Elina Palmgren

# First, plan your studies:

- *Draft* a study plan in SISU. **Do this step asap!** (See study path examples for inspiration.)
- Based on the study plan, you'll be assigned an academic mentor. (Takes a little time after you submit your study plan draft.)
- Check SISU to find your academic mentor and enroll in Moodle-area:  
<https://moodle.helsinki.fi/course/view.php?id=53395>
- Contact your academic mentor and set up a meeting to *finalise* the study plan.

# Then, start working as planned:

- Register on courses in SISU (you need to have the course in your study plan)
- Go to lectures, join the course page in Moodle, etc..
- ...

# Example study path (physics): "Quantum science & quantum technologies"

## OPTIONAL COURSES (55-85 cr)

### THEOR./ MATH. PHYS

Quantum mechanics IIa TCM302 (5cr)  
 Quantum mechanics IIb TCM303 (5cr)  
 Quantum information Ia TCM322 (5cr)  
 Quantum information Ib TCM323 (5cr)  
 Open quantum systems TCM315 (10 cr)

### CS

Design and analysis of algorithms CSM12101 (5cr)  
 Approximation algorithms CSM12106 (5cr)  
 Randomized Algorithms I CSM12104 (5cr)  
 Randomized Algorithms II CSM12105 (5cr)  
 Combinatorial optimisation CSM12107 (5cr)

### DATA

Intro to data science DATA1101 (5cr)  
 Intro to machine learning DATA11002 (5cr)  
 Advanced course in machine learning DATA12001 (5cr)  
 Computational statistics I MAST32001 (5cr)

**InstituteQ:**  
 Courses from e.g. Aalto Univ.  
 can be included. – ask Paolo!

## OTHER STUDIES (0-30 cr)

Quantum mechanics I FYS2018 (5cr)  
 Quantum computing FYS2029 (5cr)  
 Scientific computing II FYS2085 (5cr)

## COMPULSORY COURSES (35 cr)

MSc thesis (30 cr) + seminar (5 cr)

Thesis (30cr) + seminar (5 cr)

Quantum mechanics IIa TCM302 (5cr)  
 Design and analysis of algorithms CSM12101 (5cr)  
 Intro to data science DATA1101 (5cr)  
 Intro to machine learning DATA11002 (5cr)  
 Scientific computing II (5 cr)

Approximation algorithms CSM12106 (5cr)  
 Randomized Algorithms I CSM12104 (5cr)  
 Randomized Algorithms II CSM12105 (5cr)  
 Advanced course in machine learning DATA12001 (5cr)  
 Quantum computing I (5cr)

Quantum information Ia TCM322 (5cr)  
 Quantum information Ib TCM323 (5cr)  
 Open quantum systems TCM315 (10 cr)  
 Combinatorial optimisation CSM12107 (5cr)

Scientific computing III (5cr)

1. year fall

2. year spring

2. year fall

2. year spring

↑ Find a thesis supervisor!

Alternative paths for students with background in Phys/ Math/ CS/ ...

and interest in Quantum/ Atmosphere/ Stochastics/ Biophys. / ...

# Other items:

- Mailing list: *tcm-student* at *helsinki.fi*, tied to your helsinki-email. Redirect to your preferred email.
- We'll try to organise events for students and staff during the academic year. Information distributed via the mailing list.
- COVID situation: info at university [web page](#). Currently all teaching on-site; possible hybrid teaching depending on lecturer.
- Computer is needed for studies.
  - If in dire need, we have very limited resources to provide equipment.
  - Justified applications will be handled case-by-case. On first-come, first served basis. (Apply: send a free form email to Kimmo and Kai)