

ANDREA KOUTA DAGNINO

Date of Birth: October 2004 \diamond akd95@ou.ac.uk

EDUCATION

The Open University

2017-Present

BSc (Honours) in Mathematics

Predicted degree classification: First class

Level 1: MST124 (92%), MST125 (99%), M140 (84%), SM123 (92%)

Level 2: MST210 (88%), M208 (99%)

Level 3: SM358 (95%), SMT359 (100%), MST326, MS327, M337, SXP390

Deledda International School

2015-2021

MYP, IB DP1 Chemistry SL, IB DP1 Theory of Knowledge

RESEARCH/OUTREACH EXPERIENCE

Simulating Extended Hubbard models

May 2021 - August 2021

Research student

- Utilized Python libraries to simulate of strongly correlated systems using both exact and approximate diagonalization techniques (e.g. block-diagonalization and Lanczos).
- Studied the phase properties of Bosonic Hubbard models in 1D and compared with existing literature.
- Investigated the thermalization (and lack thereof) of the Extended Hubbard model, and identified models with weak ergodicity breaking.
- Accessed the computing cluster at the School of Physical Sciences to perform heavy computational tasks.
- Compiled a 40-page research report summarizing the main results from the project.

The Spectral Properties of Aperiodic Schrodinger operators

September 2021 - Present

Research student

- Too early to add many details but looks like:
- Investigating the spectral properties of aperiodic Schrodinger operators on aperiodic tilings.

SXP390 Research project

October 2021 - idk

Research student

- To be determined

Expository writings

July 2021 - present

Independent work

- Independently researched areas of mathematical and theoretical physics outside of syllabus that interested me particularly.
- Topics include: symplectic geometry and geometric quantization (understanding the duality between poisson brackets in classical physics and commutators in quantum physics), observer dependent entanglement in the context of quantum field theory in curved space-time.
- still gotta add some stuff

Fisika lectures

July 2020 - present

Youtube channel

- Produced short lecture videos on Linear algebra, Statistical mechanics and Special relativity on my youtube channel.
- Total: 4300 views.

WRITTEN WORKS

Simulating Extended Hubbard Models

May 2021 - August 2021

Research report

- Research report presenting a thorough derivation of the Extended Hubbard model from the Born-Oppenheimer approximation, a discussion of the Lanczos algorithm and its extent of applicability in strongly correlated systems, and reproducing results on the Superfluid-Mott insulator transitions in 1D. A review of the Eigenstate Thermalization hypothesis is provided, and original results on weak-ergodicity breaking Bose Hubbard models are discussed and analyzed.

Quantum Entanglement in Curved Spacetime

February 2022 - Present

Dissertation

- To be determined.

The Undergraduate Companion to Theoretical Physics

September 2020 - Present

Lecture notes

- Produced a series of lecture notes on fundamental fields in physics:
 1. Analytical and fluid mechanics (30 pages)
 2. Electromagnetism (130 pages)
 3. Quantum mechanics (340 pages)
 4. Thermal and Statistical physics (120 pages)
 5. Relativity (40 pages)
 6. Mathematical methods (420 pages)

Deriving laws of Statistical, Analytical and Fluid mechanics

June 2019 - September 2019

Literature review

- As part of my MYP Personal Project, I produced an 80-page literature review contextualizing several day-to-day phenomena such as Blackbody radiation, capillary action, Navier-Stokes equation, spin-stabilised motion with a focus on visualizing the physical processes behind these effects.

CONFERENCES/SEMINARS

Statistical and Quantum Physics Autumn School 2021

27 September 2021 - 28 September 2021

Poster presentation

- Gave a general overview of the Eigenstate Thermalization Hypothesis at the SQP Autumn School. Presented the main original results from my summer research project on weak ergodicity breaking in extended Bose-Hubbard models.

The Annual Quantum Thermodynamics Conference 2021

4 October 2021 - 8 October 2021

Attendee

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COMPUTATIONAL SKILLS

L^AT_EX, Python, Julia, Maxima, Adobe Illustrator