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Project Information

| **Area of Study** | **Project Type** | **Supervisor(s)** | **Supervisor Pre-Meeting Required?** | **S1** | **S2** | **Total** |
| --- | --- | --- | --- | --- | --- | --- |
| Computational Physics | Computation, Data Analysis, Theory | [Roger Horsley](http://www.ph.ed.ac.uk/people/roger-horsley) and [Tony Kennedy](https://www.ph.ed.ac.uk/people/tony-kennedy) | Yes | 1 | 1 | 1 |

Project Description

Quantum mechanics can be described in several different ways: wave mechanics, operator formalism and sum over particle histories. The latter method, due to Feynman, when analytically continued to imaginary time becomes suitable for numerical simulations using statistical Monte Carlo methods.

The aim of this project is for the student to understand the basic principles behind path integrals and Markov chain methods and how they can be applied to find energy and wavefunctions for the one-dimensional harmonic and anharmonic oscillator.

Prerequisite Knowledge and Skills

References

M. Creutz and B. Freedman, A Statistical Approach to Quantum Mechanics, Annals of Physics, 132 (1981) 427.

R. MacKenzie, Path Integral Methods and Applications, arXiv:quant-ph/0004090.

M. Hanada, Monte Carlo Markov Chains for dummies, arXiv:1808.08490.

M.J.E Westbroeck, P.R. King, D.D. Wedensky and S. Durr, Users' guide to Monte Carlo methods for evaluating path integrals, arXiv:1712.08508.