November 30, 2024

RPTU Kaiserslautern-Landau
Department of Physics
Pelster group

To whom it may concern,

I am writing to you to apply for the projects '*Quantum Phase Transition of the Transverse-Field Ising Chain*', and '*Bose-Einstein Condensate: Quantum System Out of Equilibrium*' at IFSC-USP. My name is David Lawton, and I am a Junior Sophister student at Trinity College Dublin studying Theoretical Physics.

I am applying for the project '*Quantum Phase Transition of the Transverse-Field Ising Chain*' as, on reading the description, and doing some brief reading on the topics mentioned, I found that it correlated well with the content of both the quantum mechanics, and statistical mechanics courses which I have recently completed. While I have not seen previously Jordan-Wigner transformations specifically, the operators and notations used are familiar. As well as this, phase transitions were covered from thermodynamics and statistical mechanics viewpoints the semester past.

I am applying for the project '*Bose-Einstein Condensate: Quantum System Out of Equilibrium*' due to the interest I have in studying condensed matter theory in the future. The potential applications of further study of superconductivity as a whole, is in my opinion, both fascinating and essential. In addition, while I might be a theoretical physics undergraduate, I do have some laboratory experience as part of my physics modules, and would be interested in learning more about the experimental side of physics.

I believe that the modules which I have taken during my studies have provided me with a solid basis of knowledge in theoretical physics, as well as some mathematics. Over the past year, with the School of Maths, I have taken modules including, but not limited to, advanced classical mechanics, quantum mechanics, statistical mechanics and classical field theory. I have also taken modules in the our School of Physics, such as computer simulation, physics for theoretical physics (general physics modules) and condensed matter physics. As well as this, I will be taking a module in electrodynamics, while further studying quantum mechanics, statistical mechanics and condensed matter, during the next semester. Further details pertaining to these modules can be found online here. The material of both the quantum mechanics and statistical mechanics modules, as well as condensed matter physics, being the most relevant to the projects.

I would also like to note, as there is no specific place to do so on the application form, that I have experience in Python, especially as applied to physics, Mathematica, and Jupyter, as well as proficiency in LaTeX.

Yours sincerely,

David Lawton.