Dear Sir or Madam:

When I first thought about pursuing a master's degree in Europe, Barcelona was the first city that came to my mind. Through the summer night coffee runs my mother, my grandparents and I made during our weeklong stay in the city, and through the plentiful amount of Spanish cuisine we consumed, the city had captured my attention. So, when it came time to look into graduate schools, I was saddened when the University of Barcelona did not have a specific quantum computing program. But now, I am thrilled that the University of Barcelona is offering the exact program I have been searching for, and I am even more thrilled to be applying to the master's program in Quantum Science and Technology.

My current research involves computing the vibrational modes and phonon density of states of a Nitrogen adsorbed surface of Copper. These calculations will be used in tandem with previous experimental data from the University of California, Irvine to investigate the mechanism of phonon detection through Raman scattering on the atomic scale.

Throughout my undergraduate curriculum as a Physics Student at the University of Nevada, Reno, I have completed advanced course work in quantum mechanics, solid-state physics, mathematical modeling, and electronics. I also supplemented my university studies by adding an additional degree in *Engineering Physics* and a minor in *Mathematics*. This supplemented course work led me to an interdisciplinary approach between science and engineering.

During my 5th semester, I became Prof. Joonhee Lee's first lab assistant. This placed me in a unique position of being able to start a research lab from scratch. My first task was to understand a quantum chemistry and materials modeling suite called Quantum ESPRESSO. This suite includes structure optimization, phonon calculations, and STM image simulation. My hunger for knowledge pushed me to discover the physics behind the software, and led me to create a series of presentations with Dr. Lee about various concepts within solid-state physics; such as phonon dispersion and Brillouin zones. This deeper understanding motivated me to explore outside the lab. I became fascinated with density functional theory and how to simulate molecules on a quantum computer. Molecular simulation and solid physics is precisely what I want to continue working on, and to bring those simulations to practical applications.

A large part of why I am pursuing an advanced degree in quantum technology is because of my experience over the summer of 2020. I had the opportunity to take part in the *Qiskit Global Summer School* lectures and labs. These lectures solidified my desire to pursue the field of quantum technologies and led me to apply to your master's programme. At the summer school, I meet high schoolers, undergraduates, and professors all interested in investigating how quantum computers work. This led me and a group of students to create an educational nonprofit organization called *Quantum Universal Education*. Our goal is to create and curate learning resources in the hopes to demystify the complexity of quantum computers. Our Secret Santa last Christmas, where instead of presents we created learning resources for each other, is a perfect example of what our organization stands for.

Out of the 4 pillars of quantum technology defined by the European Quantum Flagship, the quantum computers themselves and quantum simulation intrigues me the most. I want to apply my background in solid-state physics and materials simulation to hurdles that face the quantum computing community. I am certain that the knowledge and skills that I have gained from my lab research, university, and additional outside training would make me a valuable candidate to the newly founded master of Quantum Science and Technology offered by the Universitat de Barcelona.

Sincerely,
Richard J. Kienhöfer