This letter is in support of Edward Gheorghita's application. I have worked with Ed for over a year as an undergraduate researcher in my lab and as a student in a modern physics laboratory.

Ed is one of the most talented undergraduate students I have worked with in my 20 years of teaching. He came to Belmont as an audio engineering student but quickly gravitated to the Physics Department where he is now majoring and considering career paths that include physics and computing. Ed's grades are excellent, and he is well liked among his peers. He is commonly sought out for advice, especially when it comes to completing laboratory exercises. Ed is self-motivated and really enjoys working in the lab. He is constantly meeting with me and my colleagues about the progress he is making to improve the sensitivity of a home-built potentiostat. I am extremely impressed with the progress he has made over the past year, including an intensive 6-week research stint this summer in my lab.

Ed has been a leader in my research lab, carrying out his own project and helping to oversee other students working in the lab. Ed is working on a home-built anodic stripping voltammeter to be used in detecting lead levels in soil and drinking water. The device consists of a potentiostat, including two 14-bit digital to analog converters, used to apply potentials to dilute solutions of heavy metals and a transimpedance amplifier used to detect current consumed at the working electrode. It also has an on-board micro-SD card reader for storing data. The circuit is controlled using and Arduino prototyping platform that Ed programs using C++. Currently, the device easily detects lead levels two orders of magnitude below the EPA limit for lead in soils (350 ppm), and Ed is working to extend the sensitivity down to drinking water levels (15 ppb). In addition to programming and basic analytical chemistry techniques, Ed has also learned to design circuit boards and has worked with a 3D printer to fabricate various caps and holders for our potentiostat.

Ed is a bright and motivated student and I give him my strongest recommendation for your program.

Thom Spence
Dean, College of Sciences and Mathematics
Belmont University

Raphael Pooser
Senior Research Scientist
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831
(865) 362-9576
pooserrc@ornl.gov

University of Barcelona,
Quantum Science and Technology.
To whom it may concern:

It is my pleasure to write this letter of recommendation for Edward Gheorghita in support of his application to your graduate program. I have known Edward for just over seven months, starting in early May of 2020. I served as his undergraduate advisor for the summer 2020 Oak Ridge internship program. This program, Science Undergraduate Laboratory Internships (SULI) allows for students to gain experience at DOE national laboratories performing advanced research. At first, ORNL did not plan to have a 2020 summer internship term, but eventually we were able to support a cohort of students performing remote internship work. I met and mentored Edward entirely remotely and online. We have the 2020-unique circumstance of never having met in person (itself not unique) due to not having had the choice (rather unique to this year).

Despite our remote stance, Edward was able to carry out a successful internship. We met regularly over Zoom and Teams video channels, and Edward participated in a group that performed research together as a team, each from separate remote locations. I held virtual office hours, and Edward always had insightful questions to ask, demonstrating that he had been studying notes, lectures, and texts that we discussed during the internship. Edward shared with me some of his ideas and plans for research in graduate school. One of his ideas, quantum sensing for dark matter detection applications, is timely given the current research environment for quantum information within the US. Particularly, the National Quantum initiative has now established a robust framework within which Edward's interests fit very well. He aims "to find the theoretical limit of detection for ultralight dark matter using both established and novel methods of quantum noise reduction." This is an important question, and as evidenced by the National Quantum Science Centers' research priorities, it is clearly a question that the quantum sensing, dark matter detection communities, and Department of Energy would like to have the answer to. So I think his initiative in formulating a plan of study this early is commendable, and it shows he's going to be a strong contributor to STEM research. Plans always change, and as a grad student he may not end up working on quantum sensing in the end, but that is not really a problem. The fact that he has these ideas is what is important at this stage of his development.

For my part, I would be happy if he came to ORNL and continued to work with us, so that I could have him in person at the lab performing research for us. That means I highly recommend him for your program, as well.
Sincerely,

Raphael Pooser