Dear Members of the Search Committee:

I'm writing to apply for the tenure-track professorship in the Department of Physics and Astronomy at Texas Tech University. I completed my Ph.D. degree in Experimental Condensed Matter Physics at the University of Illinois at Urbana-Champaign (UIUC) and then worked as a research associate at Brookhaven National Laboratory (BNL). I'm currently working as a senior research & development (R&D) engineer at Intel Corporation leading materials characterization and research using advanced analytical electron microscopy/spectroscopy together with other characterization techniques for 3D XPoint memory development. With research experience in both academy and industry, I would like to pursue my research career in the vibrant research atmosphere of Texas Tech University.

My primary research interest is characterization on low-dimensional materials at nano/atomic scale via advanced electron microscopy/spectroscopy and structure modeling by density functional theory (DFT) calculations. I have characterized a wide variety of advanced materials with emphasis on subtle changes in atomic structure and electronic structure. Particularly, for iron-based superconductors, I employed atomic-resolution electron energy loss spectroscopy (EELS) in scanning transmission electron microscopy (STEM) mode to experimentally pin down the location of interstitial oxygen for the first time. I then further modeled the structure by DFT to better understand the electronic structure of the system. I also have a passion on development of novel electron microscopy techniques. When I worked at BNL, I successfully developed the protocol of electron pair distribution function (ePDF) analysis, and then modeled to quantitatively solve 3D structure of nanocrystals. This ePDF technique will be particularly useful for biomaterials and pharmaceuticals that are difficult to produce, as only a small amount of samples is sufficient to have strong interaction with electrons.

At Intel, I lead materials research for 3D XPoint memory products. I established relationships between structure/composition and electrical properties of the phase change materials, which provides the direction to improve process. Due to my contributions to the program, I successfully secured multiple million dollar funding for purchase of TEM and other equipment. My academic training and ten years of research experience in both academic and industrial environments make me confident that I can make significant contributions to the field of condensed matter physics as well as the development of new phase change materials for data storage applications.

At Texas Tech University, I plan to extend my research to characterize and design advanced materials as well as develop novel electron microscopy techniques through collaborations within the Department of Physics and Astronomy and across different departments at Texas Tech University. My research would focus on: (1) nano/atomic-scale study on layered materials, such as iron-based superconductors and transition-metal dichalcogenides, by combining STEM, EELS and nano-beam diffraction (NBD); (2) DFT calculations to model materials and interpret experimental data; (3) development of quantitative electron microscopy techniques, particularly ePDF, to determine 3D structure of nano-materials in a university laboratory environment; (4) understanding performance degradation of phase change materials for real-world industrial application.

I have also developed a network in the scientific community at Intel, UIUC, BNL, Columbia University, Argonne National Lab, Florida State University, etc. I believe this will be successfully integrated into the collaborations at Texas Tech University.

In addition to research, my teaching and mentoring experience will help me inspire students to study physics as well as encourage them to become actively involved in my research. More importantly, my experience as a senior R&D engineer at Intel Corporation will enable me to integrate my industry experience into classroom teaching and introduce students to real-world applications.

I am enthusiastic about the potential opportunity to join the Department of Physics and Astronomy at Texas Tech University. Thank you very much for your time and your consideration, and I look forward to hearing from you!

Sincerely,

Hefei Hu