

**Application Title:** **TASK Lab:** Texas A&M Advanced Spectroscopy Keystone Lab

**Lead contact for RDF Application:**

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**Key Participating Units:** College of Engineering (Yakovlev (BME), Miles (Aerospace), Lan (Mechanical)), College of Science (Scully (Institute for Quantum Science and Engineering), Sokolov (Physics and Astronomy), Sheldon (Chemistry)), College of Agriculture and Life Sciences (Agarwal (Biological and Agricultural Engineering), Kurouski (Biophysics and Biochemistry)). Underlined are Assistant Professors.

**Anticipated Request Amount (\$):** **\$1,273,711.27**

**Executive summary of this application to utilize Research Development Funds:**

The National Quantum Initiative Act outlined a 10-year plan to push forward applications using quantum science and technology. Army Futures Command is partnering with Texas A&M University to establish the nation's largest hypersonic tunnel. Multiple DOE National Labs and NASA are working closely with Texas A&M University. **All those initiatives heavily rely on availability of advanced spectroscopic tools which can assist precise optical measurements.** The major objective of this application is to establish a unique advanced optical spectroscopy facility, which can promptly place TAMU at the forefront of quantum science and precise optical measurements research by providing the most advanced equipment to perform quantum optical measurements, computations, communication, sensing and imaging (most notably, AFOSR for anticipated MURI program (FY2022; \$1.5 million per year) on Quantum Biology and DOE for anticipated Quantum Imaging for Plant Biology (FY2021; \$0.8 million per year)). It will also help several other ongoing initiatives, such as Army Futures Command and NASA, by allowing **new advanced spectroscopic capabilities to be explored and developed** to secure future continuous funding.

The Institute for Quantum Science and Engineering (IQSE) is well known around the world for the ground-breaking work in the field of theoretical quantum optics. While there are **more than 50 faculty members on campus involved in different aspects of optical research, no specialized facility related to spectroscopy exists.** The PI routinely gets multiple inquiries each month for availability of a light source at a desired wavelength or optical measurement tools to assist faculties all around campus with their research involving lasers and optical spectroscopy. The microscopic imaging and material characterization facilities are unable to customize the existing systems to users' needs. Facilities at RELIS campus, on the other hand, are not able to provide support for ground-breaking fundamental research, which is in the heart of all future developments (such as advanced hypersonic diagnostics).

This proposal requests funding to establish a state-of-the-art spectroscopic measurements facility. Initially, three university units (College of Engineering, College of Science and College of Agriculture and Life Sciences) will be involved; however, with anticipated development of methods of precise spectroscopic measurements, broader participation of other colleges, such as Geosciences (applications of *optical metrology*), Medicine (applications of *spectroscopic imaging*; *quantum communication* and *quantum computing* for data processing), and Veterinary Medicine and Biomedical Sciences (applications of *optical imaging* and *sensing*), is expected.

Such a facility, which doesn't have any other equivalent sets of equipment in the US or anywhere around the world will serve several purposes. (1) It will provide TAMU researchers with a competitive advantage for performing optical and quantum measurements related to their work. (2) It will serve a catalyzer of interdisciplinary activities. (3) It will attract other researchers from NASA, NIST, DOE, DOD, government laboratories and other academic institutions to College Station to increase visibility of Texas A&M University and to provide with strong partners for Center-level grants in the areas of quantum science and engineering. (4) It will provide a central lab for education and training of a new generation of scientists and engineers, as it is described in the National Quantum Initiative Act.