DAGSI Research Topic

1. **Research Title:** Advanced spectroscopy-based biosensors
2. **Individual Sponsor:**

Dr. Rahul Rao, AFRL/RXAS
B654/R309
2179 12'th St.
WPAFB, OH 45433-7333
rahul.rao.2@us.af.mil

3. **Academic Area/Field and Education Level:** Materials science and engineering, Biology, Chemistry, Physics (M.S. or Ph.D. level)
4. **Objectives:** To develop surface enhanced Raman spectroscopy (SERS) sensors based on low-dimensional materials for the detection of biomolecules.
5. **Description:** Rapid screening at the point of collection is highly desired for the early detection of a variety of analytes, from chemical and biological warfare agents to trace contaminants in aircraft. This research opportunity aims to address this need by developing advanced biosensors based on fluorescence and surface-enhanced Raman spectroscopy. Special focus is given to spectral detection in the low-frequency (THz) region, to measure the structural and chiral conformation of the analytes. Sensor architectures with high sensitivity will involve integration of plasmonic materials such as gold and silver nanoparticles with two-dimensional (2D) materials such as transition metal chalcogenides and graphene. In addition, high specificity will be achieved through selective binding of biorecognition elements to the plasmonic sensors. Data analysis and spectral deconvolution will be performed using statistical and/or machine learning methods, paving the way for the development of field-deployable sensors.
6. **Research Classification/Restrictions:** This research has no ITAR restrictions
7. **Eligible Research Institutions:** Universities, AFIT