2018 DAGSI Research Topic

1. **Research Title:** Synthesis and Characterization of $Si_{1-x-y}Ge_xSn_y$ Alloys

2. **Individual Sponsor:**

Dr. Bruce Claflin, AFRL/RYDH
Bldg 600
2241 Avionics Circle
WPAFB, OH 45433-7333
Bruce.claflin.1@us.af.mil

3. **Academic Area/Field and Education Level**
Physics, Chemistry, or Material Science/Chemical Vapor Deposition, Electrical, Optical, and Structural Characterization of Semiconductors (MS or PhD level)

4. **Objectives:** The goal of this research project is to develop $Si_{1-x-y}Ge_xSn_y$ for sensor applications: 1) remote sensing applications such as IR countermeasures, remote hyperspectral imaging, and high sensitivity chemical/biological weapons detection; 2) as a potential broad NIR, MWIR, and LWIR detector material for use in laser RADAR; 3) as a CMOS-compatible material for development of electro-optic integrated circuits (EOIC) including smart pixels for advanced focal plane arrays (FPAs); and 4) for free-space optical communication.

5. **Description:** The large size difference of the group IV elements Si, Ge, and Sn presents unique challenges which require the development of a new approach to allow synthesis of Sn containing alloys over a broad range of composition. Achieving this goal will require substantial effort in process development. Investigation of the gas phase chemistry and associated growth kinetics will provide a fundamental understanding of the surface physics and reaction chemistry involved in this process. Synthesis will be closely coupled with characterization of the basic structural, surface, electrical and optical properties of the resulting films to inform the growth optimization process.

6. **Research Classification/Restrictions:** Basic Research/U.S citizenship required

7. **Eligible Research Institutions:** AFIT, University of Dayton, Wright State University