1. **Research Title:** Organic Materials for Electronic and Optoelectronic Applications
2. **Individual Sponsor:** List the AFRL research topic sponsor's contact information

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3. **Academic Area/Field and Education Level**

Organic synthesis, Organic materials, Electrochemical materials (MS or PhD level)

4. **Objectives:** Covalent Organic Frameworks (COFs) represent an emerging class of crystalline and porous organic materials with significant potential across diverse applications, including gas storage, separation, catalysis, energy storage, sensing, and particularly, electronic and optoelectronic devices. Despite substantial advancements in COF research over the past two decades, their integration into electronic and optoelectronic applications relevant to the Air Force remains limited. This limitation arises from several key challenges: the inherently low conductivity of most COFs, an incomplete understanding of how individual components influence overall optoelectronic performance, and difficulties in fabricating high-quality thin films. This research aims to overcome these challenges by developing novel COF materials through synthetic chemistry approaches with significantly enhanced performance for advanced electronic and optoelectronic devices.
5. **Description:** This research proposes a systematic investigation into the fundamental influence of organic components, as well as various covalent bonds, on the overall performance of COF structures. The novel COFs synthesized will undergo comprehensive structural characterization utilizing advanced techniques such as X-ray diffraction and scattering, various spectroscopic and electron microscopy methods. For optoelectronic applications, specifically electrochromic materials, the redox properties and electrochromic performance of the COFs will be rigorously evaluated through cyclic voltammetry and spectroelectrochemistry. The electronic properties of these new COFs will be investigated via conductivity measurements, band gap analysis, charge carrier mobility studies, and so on. The successful completion of this research is poised to revolutionize COF-based electronics, thereby paving the way for the development of next-generation aerospace materials.
6. **Research Classification/Restrictions:** Unclassified Research
7. **Eligible Research Institutions:** all Ohio Universities and Research Institutes
8. **PA Approval #:** AFRL-2025-3903 Distribution A. Approved for public release: distribution unlimited.