

1. **Title:** Coupled Photonic Oscillators for Enhanced Sensitivity
2. **Individual Sponsor:**
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3. **Academic Area/Field and Education Level:** Physics, Photonics, Electrical Engineering (PhD)
4. **Objective:** The goals of this research are to develop models of, and perform experimental investigations on, coupled nonlinear photonic oscillators to offer enhanced sensitivity for the detection of environmental perturbations.
5. **Description:** Coupled photonic oscillators can exhibit a rich variety of nonlinear dynamics. With the inclusion of higher-order coupling, nonlinearity, and/or time-delayed coupling between two or more oscillators, the complexity of these systems increases. Indeed, the dynamics in such systems includes behavior that exhibits not only hysteresis, when dynamically crossing regimes, but also offers stable phase-locking, multi-stability, and period doubling routes to chaos even within well-defined operating regimes. The scope of this research seeks to investigate these characteristics in the context of enhanced sensitivity near identified windows of operation. Specifically, this project will focus on photonic systems operating near bifurcations and/or exceptional points to demonstrate an enhanced sensitivity to changes in the electromagnetic spectrum – in both the optical and RF domains. Another objective is to develop an understanding of the effect intrinsic and environmental noise has on the sensitivity of the system. Submissions should consider both theoretical and experimental demonstrations, while leveraging AFRL in-house facilities and extensive optoelectronic components/equipment to realize the latter.
6. **Research Classification/Restrictions:** Unclassified/U.S. Citizenship required
7. **Eligible Research Institutions:** All

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