Abstract
The primary goal of this project is to design and manufacture a novel detector array and readout circuit (ROIC) that incorporates plasmonic technology to create the sensor needed for Smart Lighting applications.

- The proposed integrated device has potential applications for:
  - Smart-lighting systems such as in visible light communication,
  - Light's spectral calibration
  - Energy harvesting photovoltaic systems used for self-powered sensors.

- The first prototype of detector array has been fabricated and tested.
- A preliminary electrical characterization of the shallow junction photodetector without plasmonic structure has been performed.

Technical Approach
- A detailed study of PN junction detector is performed for optimized sensitivity and performance.
- The process of CMOS-compatible plasmonic photo-detector starts with fabrication of the shallow junction photodetector arrays.
- The fabrication is performed at the Manufacturing Technology Training Center (MTTC) at the University of New Mexico (UNM).
- The shallow junction detector is used in order to obtain the most benefit of resonance surface plasmon enhancements.
- This effort consists of two distinct plasmonic structures:
  1. Nanoparticle plasmonic structures made by Prof. Hatrice Altug (Boston University)
  2. Plasmonic nanostucture made by Prof. Steve Brueck (University of New Mexico). The devices are currently in the fabrication process at MTTC facility at UNM.
- A thorough device characterization will be undertaken as soon as the fabrication processes for the plasmonic structures are complete.

Structure of planar PN Detector
(a) Pre-dep | (b) Drive in

Characterization
- A wafer with shallow Junction photodetectors were fabricated at MTTC at UNM.
- Nanoparticle plasmonic structures were fabricated at Prof. Altug's lab at Boston University on the photodetectors in regions marked as A and B.

Initial Results Before Plasmonic
- Current characterization setup used:

Conclusions
- An array of photodetectors with shallow junction were fabricated at MTTC (UNM)
- The junction is shallow to have better compatibility with plasmonic structure on the top
- Initial measurements confirms the functionality of the shallow photodetector
- Two different plasmonic structures are designed at UNM and BU.
- The UNM structure is under fabrication and the BU fabrication is complete and is now under characterization.

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Societal Benefits
Through frequent monitoring of the spectrum of light in the workplace or home, the information will be fed into a computer for analysis based on approved health guidelines for lighting. The results will be used to control the spectrum of light so as it is most healthy to the persons in the room for the conditions (e.g., time of day). The device being developed here serves as a monitor and relay agent of spectral information of light.

Increased Productivity
Healthy lighting, both in terms of spectrum and intensity, can increase individuals’ productivity. Through the technology developed here, outdoor lighting conditions can be mimicked in the office regardless of weather condition (rain or shine).