Fermi National Accelerator Laboratory
LDRD Project Data Sheet - FY17

Project ID: FNAL-LDRD-2017-003
Project title: Optical Magnetic Kinetic Inductance Devices for Future Cosmic Surveys
Principal investigator: Juan Estrada

Project description: (short description and explanation of cutting edge, high-risk, high-potential science or engineering)

To realize the potential of these sensors in cosmic surveys the energy resolution of the detectors needs to improve from the currently achievable $R=E/\Delta E=15$, to the theoretical limit for the technology R~100. The work proposed here will form a Chicagoland team (ANL-FNAL-UC) to study the current issues limiting the resolution of the sensors, and develop prototype sensors overcoming some of these issues

Tie to Mission: (explain the project's relevance or anticipated benefits to Fermilab's and DOE's missions)

The work will rely on expertise developed over the past few at FNAL for the characterization and readout electronics of these sensors, together with the expertise at ANL and UC for the design and fabrication of MKIDs. The potential of a low resolution survey has been recently recognized with the Cosmic Vision - Dark Energy group as expressed in the recent publication: "There is another possibility for a project to extend the Stage IV program: obtaining low resolution spectra for a substantial fraction of LSST objects. A number of possible technologies are under consideration, including MKIDs. "

Previous year's accomplishments: (as applicable)

Current efforts have been devoted towards the fabrication of small arrays of MKID detectors using the Univ. of Chicago nanofab facility. There are collaborators on the project who have been trained to use the facility. Initial devices have been fabricated and the performance will be measured to improve the performance for optical surveys.

Work proposed for current fiscal year and anticipated / desired results:

The recipe for a new atomic layer deposition system will be improved upon to counter the optical response and noise scatter of locally-grown films. Improvements will be implemented to have a lower Tc fabrication temperature parameter that was limiting the first devices to R~20 … similar to what has been achieved, but less than the R~100 goal.

Project funding profile: (costs, budgets, projected budgets, and total)

Prior year(s) costs	FY17	FY18	FY19	Total
N/A	27,964	157,000	164,036	349,000

Project Start Data: 3/01/2017 Total Approved Project funds: $ 349,000