NASA SBIR/STTR Technologies

"CAD Tool for Predicting the Electrical Performance and Reliability of Electronic Components in Extreme Environments"

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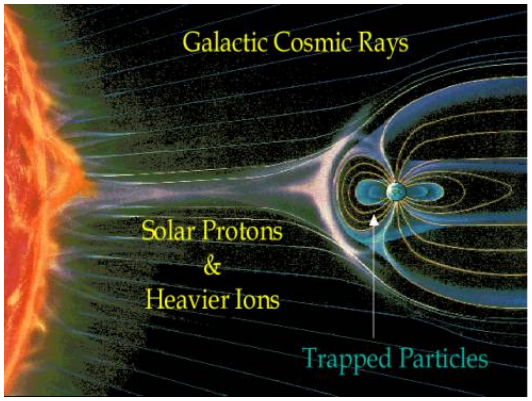
Identification and Significance of Innovation

- All exploration systems that are expected to operate on Moon or Mars for years will need reliable electronics that are able to survive and operate in a wide temperature range (-230ºC to +130 ºC), thermal-cycling environment, and high radiation levels.
- There is very little knowledge of semiconductor device behavior in extreme low temperatures (currently ongoing research) and no reliable models or design tools for such environment electronics.
- Innovation: first commercial-quality validated models and CAD tool for extreme low-T electronics, with radiation and reliability analysis using coupled semiconductor and thermal-mechanical simulation



Technical Objectives

Development and demonstration of Computer Aided Design (CAD) tool for predicting the electrical performance and reliability for extreme low-temperature electronic components and systems, including wide-temperature dependence of radiation response.

Work Plan

Phase I: • Enhance CFDRC's NanoTCAD modeling tools with newest physical models of semiconductor behavior and rad-effects in extreme low (cryogenic) temperatures, in collaboration with ongoing Research Programs (GaTech, JPL, Vanderbilt/ISDE, BAE, etc.) • Validate with experimental data from the above (assisted by Consultants of GaTech and Vanderbilt) • Feasibility demo of comp. predicting of electrical performance, radiation response, and thermal-mechanical stresses of semicon. devices in extreme low T.

Phase II: • Complete CAD tool demonstration • Link the electrical, radiation, and mechanical stress prediction with reliability studies.

NASA and Non-NASA Applications

• **NASA Applications:** Improved computer-aided design of reliable, radiation-tolerant, wide-temperature-range electronic components and integrated modules suitable for operation in the extreme environments of the Moon, Mars and other deep space destinations. Assessment and selection of candidate components.

• **Non-NASA Applications:** Potential users include other space electronics suppliers, in particular for DoD space communication and surveillance systems and commercial satellites.

Firm Contacts

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