NASA SBIR/STTR Technologies

Topic: X1.03

"Improved Design of Radiation Hardened, Wide-Temperature Analog and Mixed-Signal Electronics"

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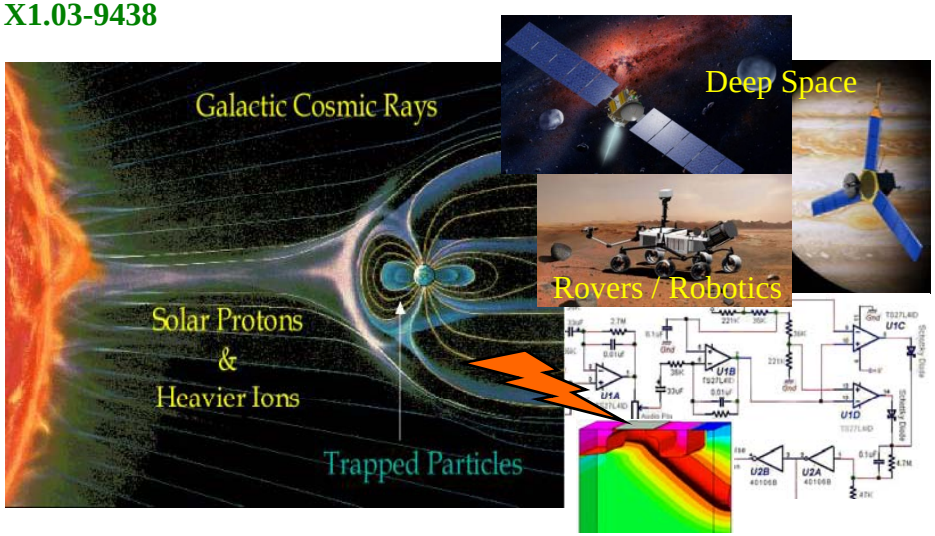
Identification and Significance of Innovation

- **NASA space exploration missions and projects** need reliable electronics that can survive and operate over a **wide temperature range (-230ºC to +130 ºC)** and **high radiation** levels.
- There is significant **need to develop & test new rad-hard wide-T** circuits and **robust CAD tools** to facilitate **design and analysis**.
- Innovations: (a) **Improved modeling/design tools,** coupled with Cadence and Geant4, enabling **innovative mixed-mode** analysis of radiation effects in analog/mixed-signal systems in extreme temp.; (b) **Novel Rad-Hard designs** (new concepts, prototype circuits, experimental verification) of SiGe HBT Analog/Mixed-Signal ICs.
- **Estimated TRL** at the beginning: **2,** and at the end (of Phase 2): **4**



Technical Objectives

◆ Design, validate, and demonstrate RHBD ICs in the SiGe HBT technologies for extreme environments. ◆ Enhance CFDRC's physics-based modeling tools (NanoTCAD, Mixed-Mode) for predicting electrical performance and radiation response of space electronics in extreme temperature range, to support RHBD design.

Work Plan

Phase 1: • Upgrade and validate CFDRC's mixed-mode tools with new models of semiconductor physics for extreme temperatures (low and high) • Use experimental data from Georgia Tech (NASA ETDP - SiGe project) for proof-of-concept demo of computational prediction of electrical & radiation response of SiGe Analog ICs in extreme environments, plus exploring new RHBD concepts.

Phase 2: • Develop and analyze new RHBD designs of SiGe HBT circuits. • Demonstrate & validate the improved TCAD models/tools • Fabricate demo ICs and test for low-T and rad-hard performance.

NASA and Non-NASA Applications

• **NASA Applications:** Radiation-hardened and wide-temperature analog and mixed-signal circuits for avionic systems used in the NASA space exploration missions. This SBIR directly supports the NASA Exploration Technology Development Program (ETDP) and Radiation Hardened Electronics for Space Exploration (RHESE) .

• **Non-NASA Applications:** Wide range of analog and mixed-signal circuits in space electronics, such as, DoD space systems (communication, surveillance, missiles), and commercial satellites.

Firm Contacts

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