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## Analytical Modeling of Mismatch-Induced Noise in Space-Grade differential Low Noise Amplifiers

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Precision space instrumentation requires a rigorous accounting of noise sources that deviate from ideal models. While traditional **differential Low-Noise Amplifier (LNA)** design focuses on intrinsic thermal and shot noise, stochastic transistor mismatch presents a critical bottleneck in reaching the theoretical noise floor. Specifically, the non-ideal elevation of **flicker noise** is dramatically magnified by these imbalances. This presentation delivers an analytical framework to quantify **LNA input-referred noise** arising from **design and fabrication offsets**. We derive mathematical relationships between **load, transconductance ( $g_m$ ), and geometric mismatches**, focusing on their role in degrading the **Common-Mode Rejection Ratio (CMRR)** and **Power-Supply Rejection Ratio (PSRR)**. Our model characterizes these imbalances as a primary driver for the **common-mode-to-differential conversion** of tail current source noise into the signal path. The framework is validated through **Monte Carlo simulations** and **measurement** results from a dedicated **IHP 130nm BiCMOS SiGe integrated circuit**, providing a robust methodology for optimizing high-sensitivity readout chains design in extreme space environments

### Speaker information

PhD 3rd year

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