

---

# Ultralow 1/f Noise in Superconducting Cobalt Dicilicide Thin Films on Silicon

Shao-Pin Chiu<sup>\*1</sup>, Sheng-Shiuan Yeh<sup>2</sup>, Chien-Jyun Chiou<sup>3</sup>, Yi-Chia Chou<sup>†3</sup>, Juhn-Jong  
Lin<sup>‡2,3</sup>, and Chang-Chyi Tsuei<sup>4</sup>

<sup>1</sup>Institute of Physics, National Chiao Tung University (IOP, NCTU) – No.1001, Daxue Rd., East Dist.,  
Hsinchu City 30010, Taiwan

<sup>2</sup>Institute of Physics, National Chiao Tung University (IOP, NCTU) – Taiwan

<sup>3</sup>Department of Electrophysics, National Chiao Tung University (EP, NCTU) – Taiwan

<sup>4</sup>(Emeritus from) IBM Thomas J. Watson Research Center – Taiwan

## Abstract

High-precision resistance noise measurements indicate that the epitaxial CoSi<sub>2</sub>/Si heterostructures at 150 K and 2 K (slightly above its superconducting transition temperature T<sub>c</sub> of 1.54 K) exhibit an unusually low 1/f noise level in the low frequency range. This corresponds to an upper limit of Hooge constant  $\gamma \leq 3 \times 10^{-6}$ , about 100 times lower than that of single-crystalline aluminum films on SiO<sub>2</sub>. Supported by high-resolution cross-sectional transmission electron microscopy studies, our analysis reveals that the 1/f noise is dominated by excess interfacial Si atoms and their dimer reconstruction induced fluctuators. Unbonded orbitals (i.e., dangling bonds) on excess Si atoms are intrinsically rare at the epitaxial CoSi<sub>2</sub>/Si(100) interface, giving limited trapping-detrapping centers for localized charges. With its excellent normal-state properties, CoSi<sub>2</sub> has been used in Si-based integrated circuits for decades. The intrinsically low noise properties could have high potential for developing quiet qubits and scalable superconducting circuits for future quantum computing.

---

\*Speaker

†Corresponding author: ychou@nctu.edu.tw

‡Corresponding author: jjlin@mail.nctu.edu.tw