

# High performance solid-state quantum devices by micro-nano fabrication

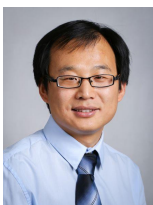
*University of Science and Technology of China, Hefei, China*

**Yongheng Huo**

**Email: [yongheng@ustc.edu.cn](mailto:yongheng@ustc.edu.cn)**

Quantum devices serve as foundational prerequisites for the realization of quantum information protocols. In this report, I will introduce our progress on solid-state quantum devices fabricated through innovations of film growth and micro-nano technologies. Firstly, I will report semiconductor quantum dot single photon source (QD SPS). With optimized MBE growth and microcavity, we have realized QDSPS with a total system efficiency of 71.2%, which for the first time surpasses the loss-tolerant threshold for efficient linear optical quantum computing [Nat. Photon. 19, 387 (2025)], about 17 years after the protocol was proposed [PRL 100, 060502 (2008)]. Secondly, using epitaxial metal film and 3D flip-chip bonding, we obtained high-performance multiqubit superconducting quantum processors, which supports experiments as genuine entanglement up to 51 superconducting qubits [Nature 619, 738 (2023)] and fractional quantum Hall state with interacting photons [Science 384, 579 (2024)]. The latest work of 105-qubit “Zuchongzhi 3.0” processor has demonstrated new benchmark in quantum computational advantage [PRL 134, 090601 (2025)]. Finally, I will report our recent work about ultra-high-reflectivity low-noise optical mirrors. They are key elements for precision measurements as optical atomic clock and high-sensitivity trace molecule detection, etc. By introducing RF-induced substrate bias into reactive magnetron sputtering [Rev. Sci. Instrum. 95, 045107 (2024)], we have obtained optical coatings with reflectivity over 99.9995%.

## **Short Bio:**



**Yongheng Huo** received his PhD degree in Physical Electronics from the Institute of Semiconductors, Chinese Academy of Sciences. He is now a professor at the University of Science and Technology of China.