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Title: Enhancing the brightness of electrically driven single-photon sources using color centers in silicon carbide

Abstract:

Practical applications of quantum information technologies exploiting the quantum nature of light require efficient and bright true single-photon sources which operate under ambient conditions. Currently, point defects in the crystal lattice of diamond known as color centers have taken the lead in the race for the most promising quantum system for practical non-classical light sources. This work is focused on a different quantum optoelectronic material, namely a color center in silicon carbide, and reveals the physics behind the process of single-photon emission from color centers in SiC under electrical pumping. We show that color centers in silicon carbide can be far superior to any other quantum light emitter under electrical control at room temperature. Using a comprehensive theoretical approach and rigorous numerical simulations, we demonstrate that at room temperature, the photon emission rate from a p–i–n silicon carbide single-photon emitting diode can exceed 5 Gcounts/s, which is higher than what can be achieved with electrically driven color centers in diamond or epitaxial quantum dots. These findings lay the foundation for the development of practical photonic quantum devices which can be produced in a well-developed CMOS compatible process flow.

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