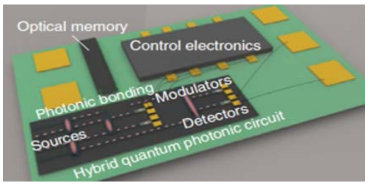
Scientific Highlight

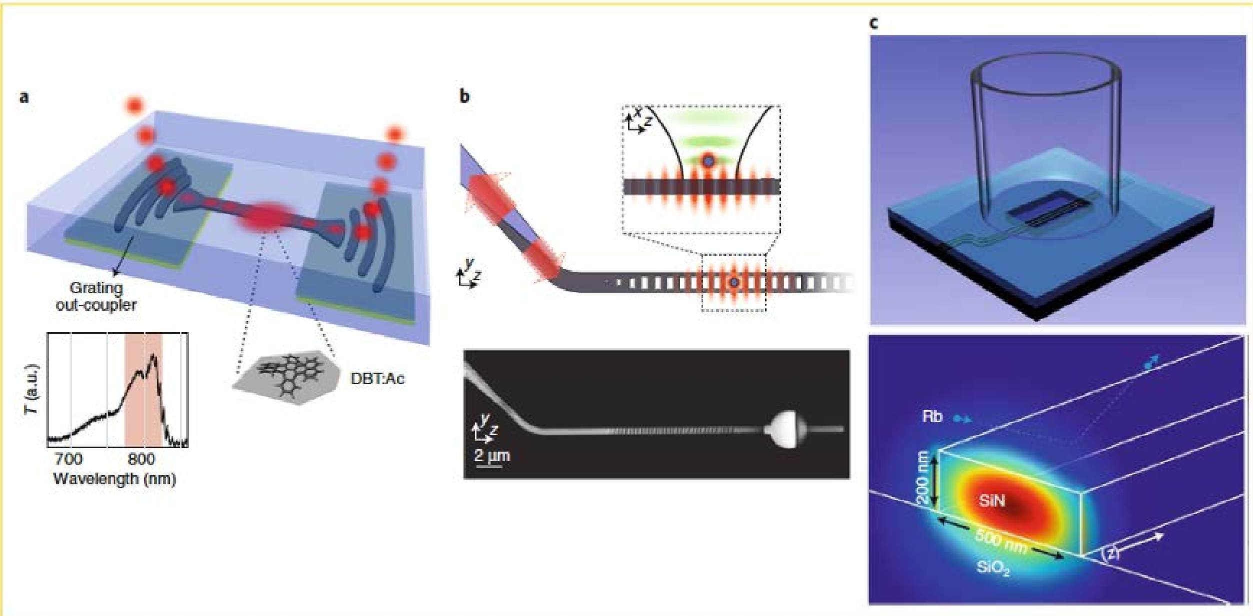
Review on hybrid integrated quantum photonic circuit

Recent developments in chip-based photonic quantum circuits have radically impacted quantum information processing. However, it is challenging for monolithic photonic platforms to meet the stringent demands of most quantum applications.Hybrid platforms combining different photonic technologies and different materials in a single functional unit have great potential to overcome the limitations of monolithic photonic circuits.



Several key functional elements integrated on single photonic chip

Researchers from the KTH Royal Institute of Technology, Stockholm, Sweden, the University of Muenster, Germany, the National Institute of Standards and Technology, Gaithersburg, USA, and IRIS Adlershof review the progress of hybrid quantum photonics integration. They discuss important design considerations, including optical connectivity and operation conditions, and outline the roadmap for realizing future advanced large-scale hybrid devices, beyond the solid-state platform, which hold great potential for quantum information applications.



Three examples of hybrid integration: (a) Dibenzoterrylene embedded in a rigid matrix of crystalline anthracene as molecule single-photon source on a silicon nitride waveguide [Lombardi, et al. ACS Photon. 5, 126–132 (2018)], (b) Nonlinear phase gate in a hybrid atomic-photonic system [Tiecke, et al., Nature 508, 241–244 (2014)], (c) Hybrid atomic cladding photonic waveguide demonstrating light–matter interaction at room temperature [Stern, et al., Nat. Commun. 4, 1548 (2013)].

Hybrid integrated quantum photonic circuits

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