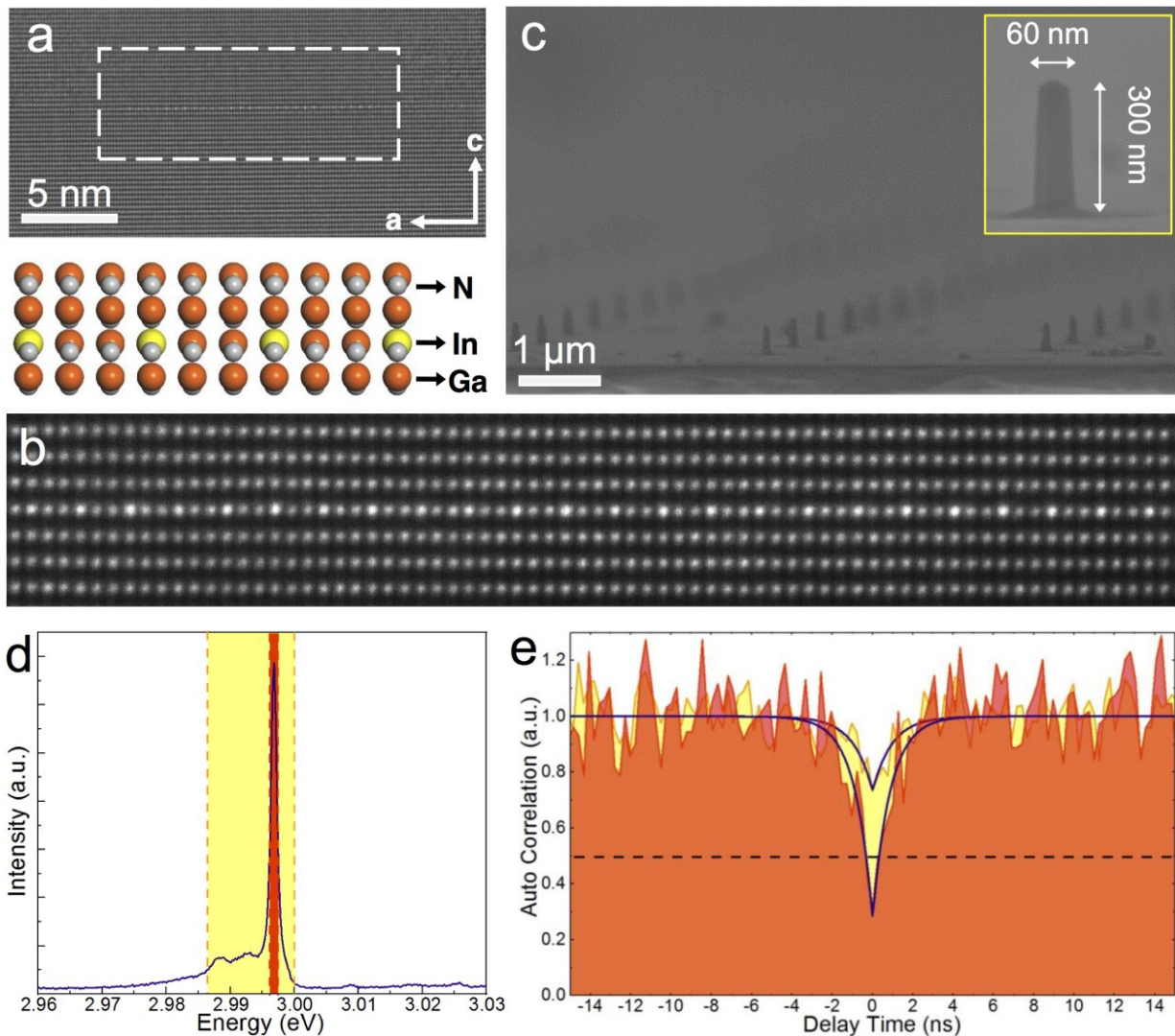


# Single photon emission from isolated monolayer islands of InGaN

September 23 2020



a, TEM cross-section image of an In(Ga)N/GaN single monolayer island. b, A high magnification HAADF-STEM image of the In(Ga)N single atomic monolayer, while the top panel shows the corresponding atomic schematic. c,

Tilted-view SEM image of arrays of after wet-etched and regrown nanoimprinted In(Ga)N/GaN pillars, inset of the figure represents a typical pillar. d, Photoluminescence spectrum of the emitter from the chosen measurement regions at 8 K under 355 nm excitation. e, Autocorrelation of the main peak as the orange shaded rectangle and together with the lower energy peaks as the yellow shaded rectangle in figure d. Credit: Xiaoxiao Sun, Ping Wang, Tao Wang, Ling Chen, Zhaoying Chen, Kang Gao, Tomoyuki Aoki, Li Mo, Jian Zhang, Tobias Schulz, Martin Albrecht, Weikun Ge, Yasuhiko Arakawa, Bo Shen, Mark Holmes, and Xinqiang Wang

Single photon emitters are essential devices for the realization of future optical quantum technologies including optical quantum computing and quantum key distribution. Towards this goal, Scientists in China and Japan identified and characterized a novel type of quantum emitter formed from spatially separated monolayer islands of InGaN sandwiched in a GaN matrix. This new structure could open new opportunities for further quantum devices.

Non-classical light sources such as single [photon](#) emitters are essential devices for the realization of future optical quantum technologies including optical quantum computing and quantum key distribution. To date several strategies, including single atoms, quantum dots (QDs), single molecules, and point defects, have been used to explore the development of single photon emitters. Although great strides have been made in the development of solid-state single photon emitters, including high purity and indistinguishability from QDs, and high emission rates from both defects and QDs, each technology has its own drawbacks. Therefore, basic research into the development of [single photon emitters](#) using new materials and techniques is crucial.

In a new paper published in *Light Science & Applications*, a team of scientists from State Key Laboratory for Mesoscopic Physics and

Frontiers Science Center for Nano-optoelectronics, School of Physics, Peking University, China, and Institute of Industrial Science, The University of Tokyo, Japan have developed a novel type of quantum [emitter](#) formed from spatially separated monolayer islands of InGaN sandwiched in a GaN matrix. They first grew a planar structure of InGaN monolayer islands using [molecular beam epitaxy](#), and then patterned the sample into pillars using nanoimprint lithography and inductively-coupled plasma reactive-ion etching. Detailed optical analysis of the emission properties of the isolated monolayer islands showed that the main emission line could be spectrally filtered to act as a bright, and fast single photon emitter at a wavelength of ~ 400 nm, with a high degree of photostability.

"III-nitride materials were chosen for this study because they are expected to offer several advantages for the development of future devices, including a wide tunability in emission wavelength, compatibility with silicon substrates for growth, and support from a worldwide industrial infrastructure for device fabrication due to their extended use in modern day optoelectronics and power [device](#) applications," say the researchers.

The team also suggests that the next step in the research is to work towards higher emission purity, and that future developments (possibly using other materials) could lead to the realization of emitters operating at wavelengths compatible with conventional fiberoptic systems.

**More information:** Xiaoxiao Sun et al, Single-photon emission from isolated monolayer islands of InGaN, *Light: Science & Applications* (2020). [DOI: 10.1038/s41377-020-00393-6](https://doi.org/10.1038/s41377-020-00393-6)

Provided by Chinese Academy of Sciences

Citation: Single photon emission from isolated monolayer islands of InGaN (2020, September 23) retrieved 21 June 2024 from <https://phys.org/news/2020-09-photon-emission-isolated-monolayer-islands.html>

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