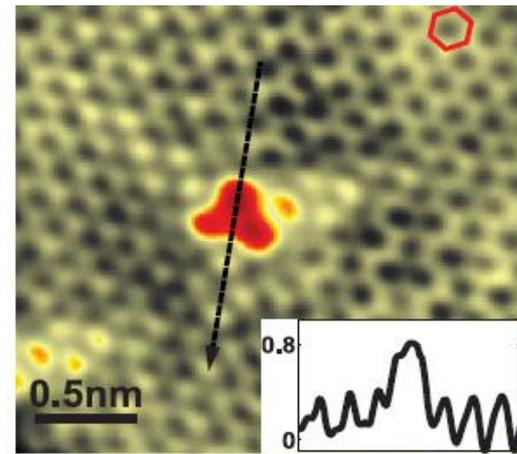
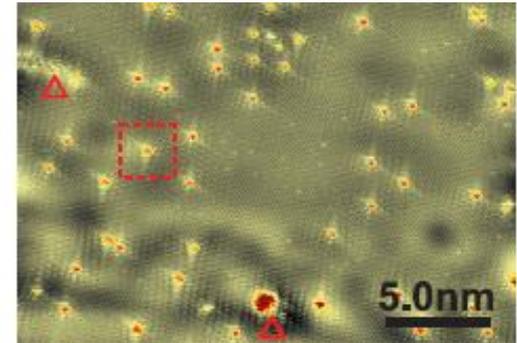


# How Nitrogen Improves Graphene Films

- A form of carbon just one atom thick, known as monolayer graphene, could make a big impact on the field of nanoelectronics – very tiny, very fast electronic components that could radically change computers and other devices. But scientists still need to better understand its properties.
- Researchers working in part at NSLS beamline U7A have uncovered atomic-level information about monolayer graphene that was “doped” with nitrogen atoms.
- In this type of doping, a nitrogen atom replaced a carbon atom at random points in the graphene's honeycomb-shaped lattice. Roughly three nitrogens were present for every 1,000 carbons.
- The nitrogen increased the film's carrier density (the number of electrons that contribute to its conductivity) yet disrupted the electronic structure only in the immediate area around each one. This may be explained in part by data obtained at U7A, which shows the nitrogen as a single molecular species oriented in a way that most easily shares its electrons with neighboring carbons.
- This work suggests that nitrogen doping may be an excellent way to create high-quality monolayer graphene films with superior electronic properties.



Top: A scanning tunneling microscope image of the nitrogen-doped carbon film (red dots are nitrogen atoms). Bottom: A close-up view, showing the carbon's honeycomb lattice and a single nitrogen dopant. Inset: A line profile of the surface, showing the height of the dopant (0.8 angstroms, or .08 nanometers (nm)).