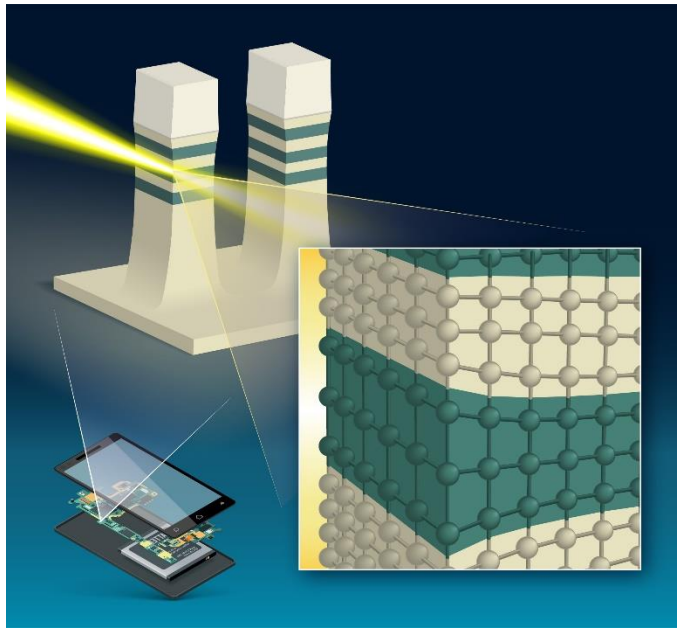
Beamline: HXN

# Seeing Inside Next-Generation Microelectronics Using X-rays



This artist's impressions shows how x-rays made it possible to study the distortions of the layers in the material. The atoms at the edges of the layers are either squished tighter or pulled apart, creating a bend along the different layers.

## Scientific Achievement

Scientists from NSLS-II & IBM found two competing mechanisms that contribute to the deformation of nanosheets, which are novel structures employed for next-gen Gate-All-Around Field Effect Transistors (GAAFET), by using x-ray diffraction mapping with 12 nm resolution.

## Significance and Impact

The performance of next-generation nanoelectronic devices relies on the precise understanding of their inner structure, which can only be achieved if researchers can visualize the deformations of these materials using a non-destructive method.

## Research Details

- Studied strain variation in nanosheets made of Si and Si/Ge layers used for GAAFET using the HXN beamline at NSLS-II.
- Identified two competing mechanisms, one long-range and the other short-range, through non-destructive nanoscale diffraction mapping
- Found the short-range effect was dominant within a length scale of nanosheet thickness from the edge.
- Associated the second deformation with the nanosheet layering.

C.E. Murray, H. Yan, C. Lavoie, J. Jordan-Sweet, A. Pattammattel, K. Reuter, M. Hasanuzzaman, N. Lanzillo, R. Robison, N. Loubet. *Nature Communications Engineering* 1, 11 (2022)

This work was performed at the National Synchrotron Light Source II (NSLS-II).