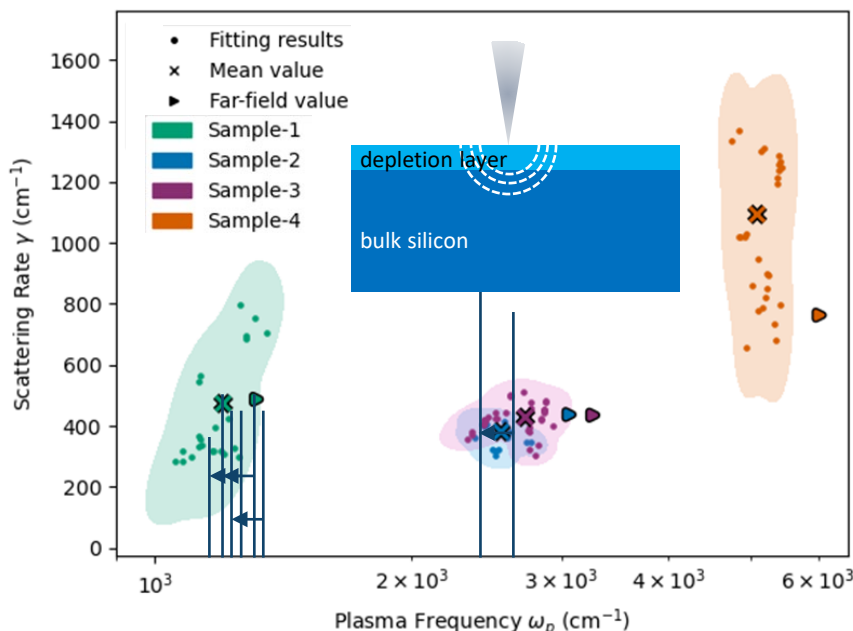


Measuring Semiconductors with Infrared Nanospectroscopy



Comparison between infrared (IR) nanospectroscopy (dots + crosses) and conventional IR spectroscopy (triangles) confirms accuracy and precision for determining nanoscale electronic properties. It also reveals a consistent decrease in plasma frequency, consistent with a surface depletion layer.

L. Wehmeier, Z. Zhou, M. Tsuneto, H. Zhao, S. N. Gilbert Corder, H.A. Bechtel, V. A. Martinez, C. C. Homes, D. N. Basov, M. Liu, and G. L. Carr, "Quantitative Infrared-to-Terahertz Nanospectroscopy of Semiconductors", ACS photonics, 13 (16), 4902-4913 (2026).
<https://doi.org/10.1021/acsphotonics.6c01553>

Scientific Achievement

Synchrotron infrared nanospectroscopy shows promise for measuring the electronic properties of nanoscale semiconductors that are challenging to measure using existing methods.

Significance and Impact

The approach could eventually be applied as a precision tool to measure other advanced materials used in next-generation electronics.

Research Details

- Using synchrotron infrared nanospectroscopy at NSLS-II's MET beamline, the team employed a combination of infrared light with atomic force microscopy to probe areas of roughly 10 nanometers.
- This technique can measure how many mobile charge carriers there are and how efficiently they move through the material.
- In silicon samples, measurements detected about 30% fewer charge carriers near the surface than measurements deeper into the material, suggesting sensitivity to surface depletion.