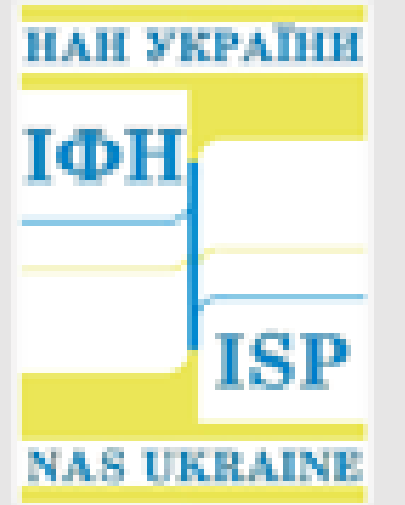


# Visualization of a photosensitive area of infrared photodiodes using two-dimension scanning method

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Characterization of the spatial uniformity of photosensitivity is an important step in the development and optimization of infrared photodetectors. Non-uniformity of the photoresponse can significantly influence on the performance of detectors in imaging systems, spectroscopy, and precision optical measurements. Therefore, investigation of the spatial distribution of sensitivity provides valuable information about material quality, device fabrication processes, and the presence of local defects affecting detector performance.

The non-uniformity of photosensitivity (Fig. 1) of an InSb infrared photodiodes developed and fabricated at the V. Lashkaryov Institute of Semiconductor Physics of the NAS of Ukraine [1] was investigated. The photodiodes have performance characteristics comparable with commercially available ones at liquid nitrogen working temperature. Its topology dimensions are  $230 \times 40 \mu\text{m}^2$ .

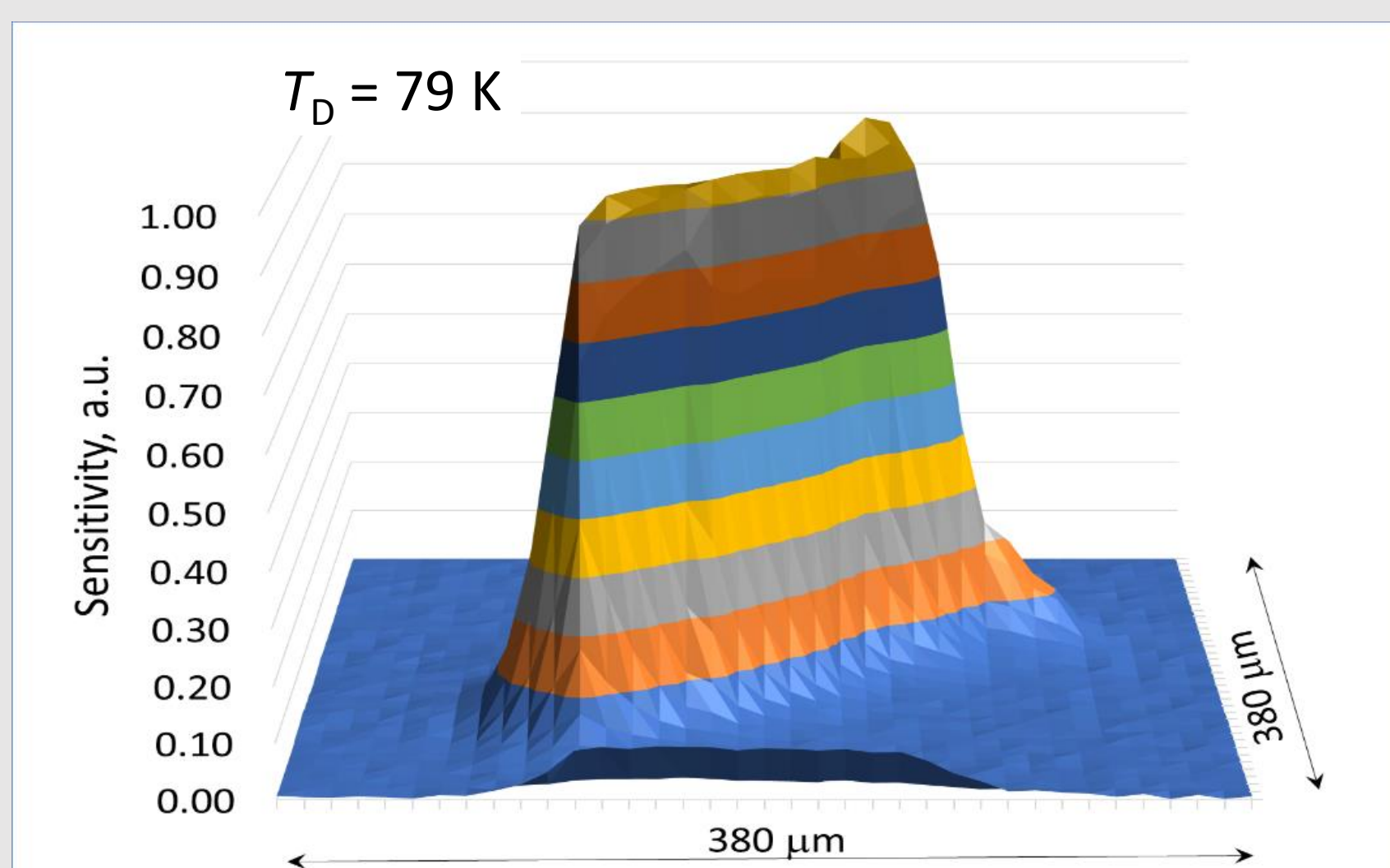


Fig. 1. 3D mapping of the InSb photodiode photosensitivity at liquid nitrogen temperature  $T_D$ . The image was created using a 'Surface' chart type in MS Excel.

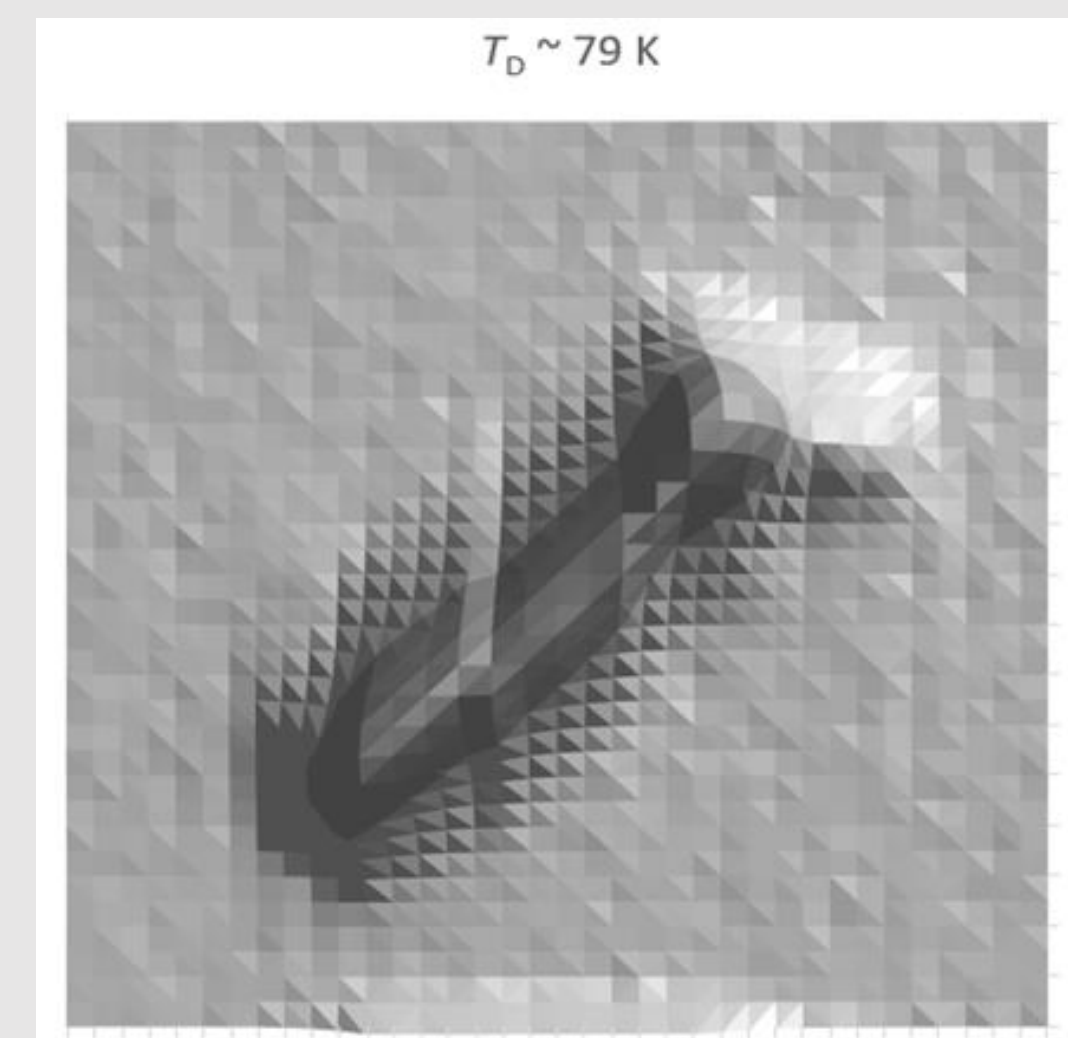
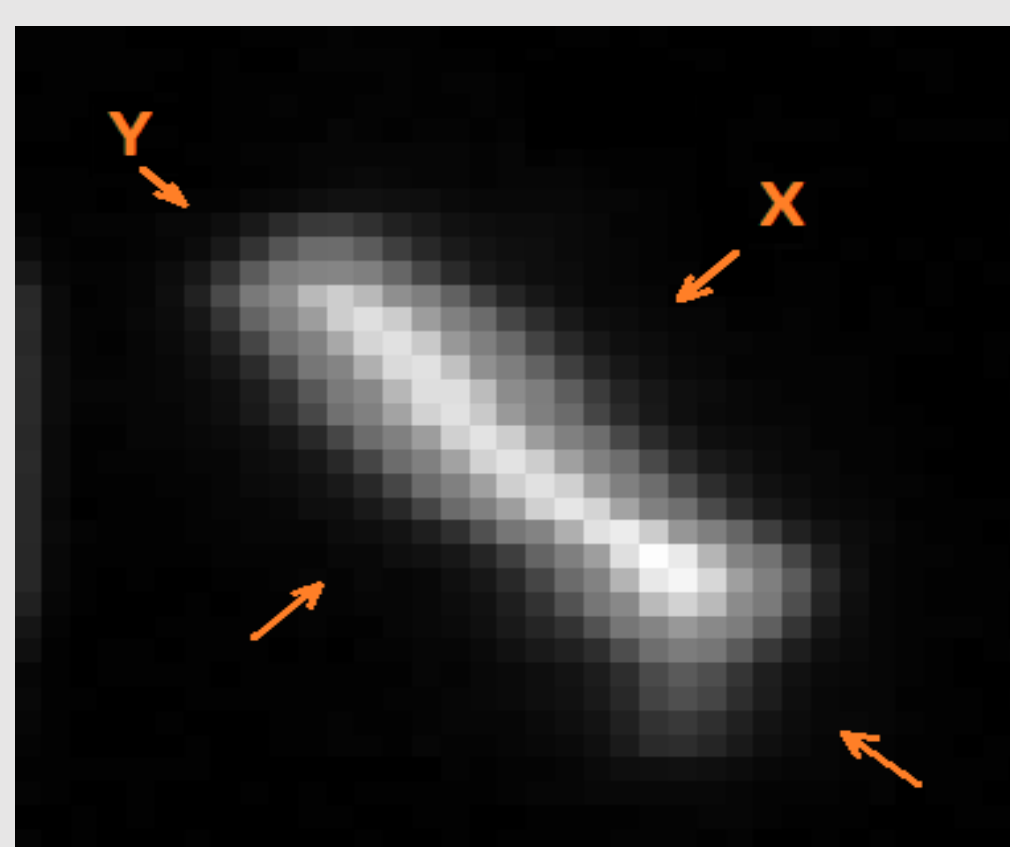
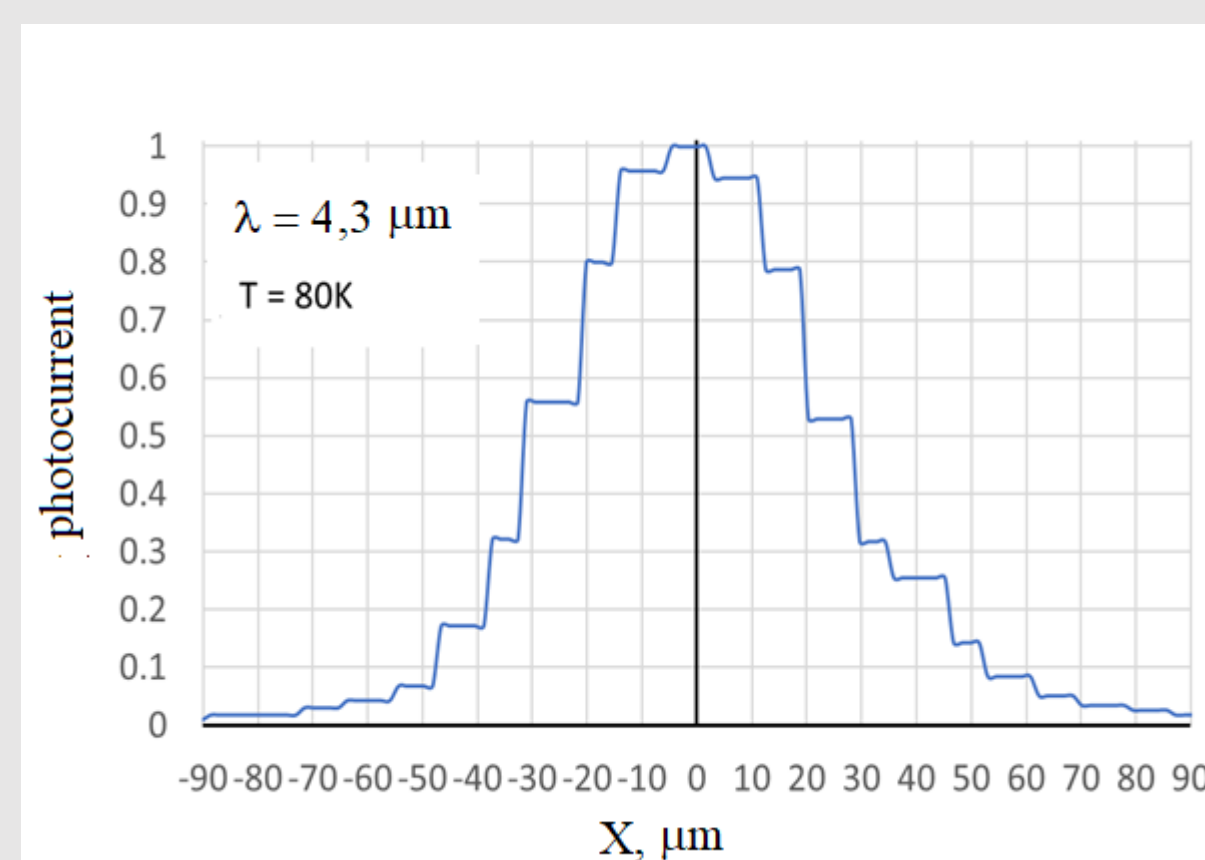


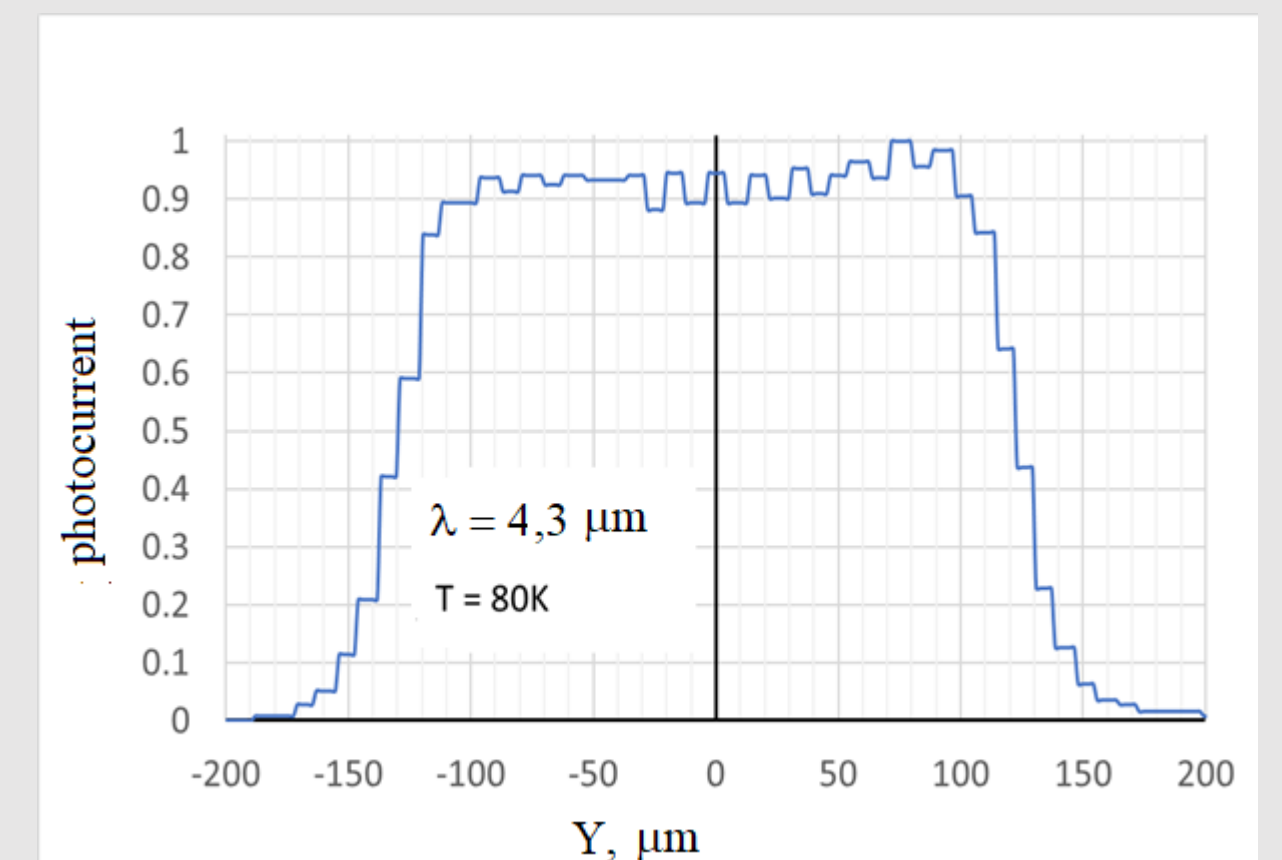
Fig. 2. Visualisation of the spatial distribution of the InSb diode photoresponse at a temperature  $T_D$  of 79 K. Optical probe wavelength, maximum photocurrent, and signal-to-noise ratio of measurements are  $4,3 \mu\text{m}$ , 74 pA, and  $\sim 350$  respectively. Scan step is  $10 \mu\text{m}$ . The image was created using a 'Surface' chart type in MS Excel.



a



b



c

Fig. 3. A sensitive area of the  $230 \times 40 \mu\text{m}^2$  photodiode (a) and photocurrent distribution along the 'X' (b) and 'Y' (c) directions. A spot diameter of an optical probe was  $<30 \mu\text{m}$ .

The surface distribution of photosensitivity was investigated with the assistance of an optical probe [2] at  $\lambda = 4.3 \mu\text{m}$  radiation source wavelength. A spot diameter of a focused radiation was less than  $30 \mu\text{m}$ . Visualization of photosensitivity allows determining the effective sensitive area of the detector, sensitivity uniformity, and crosstalk coefficient between neighboring detectors.

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[1] S. V. Sapon, M. S. Boltovets, O. A. Kulbachynskiy, V. V. Zabudsky, O. G. Golenkov, V. V. Korotyeyev, A. A. Efremov, Semiconductor physics, quantum electronics and optoelectronics 27, 356-365 (2024). <https://doi.org/10.15407/spqeo27.03>

[2] O. G. Golenkov, A. V. Shevchik-Shekera, V. V. Zabudsky, I. O. Lysiuk, Z. F. Tsybrii, A. S. Stanislavskiy, S. V. Korinets, A. Yu. Shekera, Sensor Electronics and Microsystem Technologies 22, 30-39 (2025). <https://semst.onu.edu.ua/article/view/343569/336882>