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Corresponding author(s): Libo Zhang

Lasing Reporting Summary

Nature Research wishes to improve the reproducibility of the work that we publish. This form is intended for publication with all accepted papers reporting claims of lasing and provides structure for consistency and transparency in reporting. Some list items might not apply to an individual manuscript, but all fields must be completed for clarity.

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Experimental design

Please check: are the following details reported in the manuscript?

1. Threshold

Plots of device output power versus pump power over a wide range of values indicating a clear threshold	☐ Yes ☒ No	This information is not reported/not relevant because our research focuses on photodetection mechanisms rather than light emission or lasing phenomena. Our device operates as a photodetector without any pump-power dependent threshold behavior characteristic of lasers.

2. Linewidth narrowing

Plots of spectral power density for the emission at pump powers below, around, and above the lasing threshold, indicating a clear linewidth narrowing at threshold	☐ Yes ☒ No	Our device functions as a light detector rather than a light emitter or laser source.
Resolution of the spectrometer used to make spectral measurements	☐ Yes ☒ No	This information is not reported/not relevant because our work does not involve emission spectroscopy measurements.

3. Coherent emission

Measurements of the coherence and/or polarization of the emission	☐ Yes ☒ No	This information is not reported/not relevant because our photodetection research does not involve generating coherent light emission.

4. Beam spatial profile

Image and/or measurement of the spatial shape and profile of the emission, showing a well-defined beam above threshold	☐ Yes ☒ No	This information is not reported/not relevant because our photodetector does not emit a beam.

5. Operating conditions

Description of the laser and pumping conditions *Continuous-wave, pulsed, temperature of operation*	☒ Yes ☐ No	line 106 page 4
Threshold values provided as density values (e.g. W cm^{-2} or J cm^{-2}) taking into account the area of the device	☐ Yes ☒ No	This information is not reported/not relevant because our research focuses on photodetection rather than lasing phenomena. Our photodetector device does not exhibit threshold behavior that would require reporting power or energy density values per unit area.

6. Alternative explanations

Reasoning as to why alternative explanations have been ruled out as responsible for the emission characteristics *e.g. amplified spontaneous, directional scattering; modification of fluorescence spectrum by the cavity*	☐ Yes ☒ No	This information is not reported/not relevant because our work investigates photodetection mechanisms rather than light emission. We do not need to rule out alternative explanations for emission characteristics since our device functions as a photodetector and not a light source

7. Theoretical analysis

Theoretical analysis that ensures that the experimental values measured are realistic and reasonable *e.g. laser threshold, linewidth, cavity gain-loss, efficiency*	☐ Yes ☒ No	This information is not reported/not relevant because our research does not involve laser parameters such as threshold, linewidth, cavity gain-loss, or efficiency.

8. Statistics

Number of devices fabricated and tested	☒ Yes ☐ No	five

Statistical analysis of the device performance and lifetime (time to failure)	☐ Yes ☒ No	This information is not reported/not relevant