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Giant microwave photo-conductance of a tunnel point contact with a bridged gate

Appl. Phys. Lett. **107**, 072112 (2015); <https://doi.org/10.1063/1.4928733>A. D. Levin¹, G. M. Gusev^{1, a)}, Z. D. Kvon^{2,3}, A. K. Bakarov^{2,3}, N. A. Savostianova⁴, S. A. Mikhailov⁴, E. E. Rodyakina^{2,3}, and A. V. Latyshev^{2,3}[View Affiliations](#)[View Contributors](#) PDF

We study the microwave photo-response of a quantum point contact (QPC) formed on a GaAs/AlGaAs heterostructure with a high-electron-mobility two-dimensional electron gas. The QPCs are fabricated by two types of gates: a traditional split gate and a specially designed *bridged gate*. We observe a three orders of magnitude enhancement of the dark QPC conductance in the tunneling regime at the incident microwave power density of $\sim 10 \text{ mW/cm}^2$. The response of the bridged-gate structure is more than ten times larger than that of the split-gate QPC. This giant effect and the difference between the two types of gates are explained by the influence of microwaves on the steady-state electron distribution function in the vicinity of the tunnel contact. Experimental results are in good quantitative agreement with theoretical calculations. The bridged-gate QPC can be used for the creation of highly sensitive detectors of electromagnetic radiation.

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REFERENCES

1. H. van Houten and C. W. J. Beenakker, Phys. Today **49**(7), 22 (1996).
<https://doi.org/10.1063/1.881503>, [Google Scholar](#), [Crossref](#)



- P. Kouwenhoven, D. van der Marel, and C. T. Foxon, Phys. Rev. Lett. **60**, 848 (1988). <https://doi.org/10.1103/PhysRevLett.60.848>, [Google Scholar](#), [Crossref](#)
-
3. D. Wharam, T. J. Thornton, R. Newbury, M. Pepper, H. Ahmed, J. E. F. Frost, D. G. Hasko, D. C. Peacock, D. A. Ritchie, and G. A. C. Jones, J. Phys. C: Solid State Phys. **21**, L209 (1988). <https://doi.org/10.1088/0022-3719/21/8/002>, [Google Scholar](#), [Crossref](#)
-
4. P. S. Dorozhkin, S. V. Tovstonog, S. A. Mikhailov, I. V. Kukushkin, J. H. Smet, and K. von Klitzing, Appl. Phys. Lett. **87**, 092107 (2005). <https://doi.org/10.1063/1.2035883>, [Google Scholar](#), [Scitation](#)
-
5. Z. D. Kvon, G. M. Gusev, A. D. Levin, D. A. Kozlov, E. E. Rodyakina, and A. V. Latyshev, Pis'ma Zh. Eksp. Teor. Fiz. **98**, 806 (2013), http://www.jetpletters.ac.ru/ps/2027/article_30564.shtml; [Google Scholar](#)
Z. D. Kvon , G. M. Gusev , A. D. Levin , D. A. Kozlov , E. E. Rodyakina , and A. V. Latyshev, JETP Lett. **98**, 713 (2014). <https://doi.org/10.1134/S0021364013240132>, [Google Scholar](#), [Crossref](#)
-
6. M. A. Zudov, R. R. Du, J. A. Simmons, and J. L. Reno, Phys. Rev. B **64**, 201311 (2001). <https://doi.org/10.1103/PhysRevB.64.201311>, [Google Scholar](#), [Crossref](#)
-



<https://doi.org/10.1038/nature01277>, [Google Scholar](#), [Crossref](#)

8. M. A. Zudov, R. R. Du, L. N. Pfeiffer, and K. W. West, Phys. Rev. Lett. **90**, 046807 (2003). <https://doi.org/10.1103/PhysRevLett.90.046807>,

[Google Scholar](#), [Crossref](#)

9. S. A. Mikhailov and N. A. Savostianova, Phys. Rev. B **74**, 045325 (2006).

<https://doi.org/10.1103/PhysRevB.74.045325>, [Google Scholar](#),
[Crossref](#)

10. L. D. Landau and E. M. Lifshitz, Quantum Mechanics (Non-Relativistic Theory) (Elsevier, Oxford, 1994). [Google Scholar](#)

11. M. I. Dyakonov and M. Shur, IEEE Trans. Electron Devices **43**, 380 (1996). <https://doi.org/10.1109/16.485650>, [Google Scholar](#), [Crossref](#)

12. J.-Q. Lü, M. S. Shur, J. L. Helsner, L. Sun, and R. Weikle, IEEE Electron Device Lett. **19**, 373 (1998). <https://doi.org/10.1109/55.720190>,
[Google Scholar](#), [Crossref](#)

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