

# Microwave-Assisted Unidirectional Superconductivity in Al-InAs Nanowire-Al Junctions under Magnetic Fields

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The work addresses enhancement of superconducting diode effect (SDE) and appearance of unidirectional superconductivity (USC) in Al-InAs nanowire-Al junctions under microwave irradiation and magnetic fields. The SDE describes asymmetric critical currents in superconducting systems. Recently, the SDE has received considerable interest. When one of the critical currents is zero it is called ideal SDE<sup>[1]</sup>. To go further, when both of the critical currents is on the same side of zero it is called USC. Two theoretical studies have investigated the enhancement effect of microwave on SDE and the causes of USC appearance<sup>[2,3]</sup>. But there is a dearth of experiments. We have made relevant experimental studies and some novel results were found.

Our research is based on Josephson junctions. The simple structure of this device can lead to more extensive research. And our experiment has good reproducibility. The results of our work are summarized briefly as follows: (a) The USC has been observed for the first time in a semiconductor Josephson junction. (b) The enhancement effect of microwave irradiation on SDE under different magnetic fields was studied systematically. (c) The simulation results of the RSJ model can't explain the experimental results well. Nonequilibrium transport may play a role in this periodically driven system.

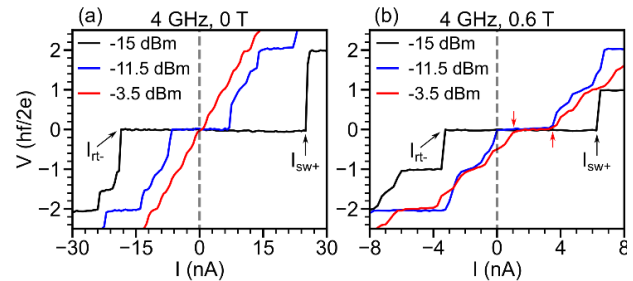


Fig.1. Zero-field and finite-field voltage-current characteristics under microwave irradiation. The microwave frequency and  $B$  are noted at the top of each panel. The current is scanned in the positive direction.

## References

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