SPECTROSCOPY

## A deeper probe of electronic structure

*Science* **358**, 901–906 (2017)

Techniques such as angle-resolved photoemission spectroscopy and scanning tunnelling microscopy can be used to examine the electronic structure of a material. However, they can only probe its surface and do not work with insulating samples. Joonho Jang, Raymond Ashoori and colleagues at Massachusetts Institute of Technology and Princeton University now report a tunnelling spectroscopy method that can be used to study a two-dimensional electronic system embedded in a semiconductor.

The technique, which is termed momentum- and energy-resolved tunnelling spectroscopy (MERTS), uses a vertical device that contains two adjacent GaAs quantum wells, separated by a thin barrier made of $Al_{0.8}Ga_{0.2}As$. Electrons with carefully defined energy and momentum are generated in the top (probe) quantum well layer and injected, via tunnelling, into the bottom (target) quantum well layer. The electrons from the probe layer can only tunnel into the target layer when their energy and momentum matches the available states. Because of this, the tunnelling current directly relates to the electronic density of states, giving a detailed picture of the spectral function of the material. Jang and colleagues also used the technique to investigate many-body effects in GaAs quantum wells.

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Published online: 8 January 2018
https://doi.org/10.1038/s41928-017-0017-5