Lecture 4:

Andreev bound states

(SIS junction, quantum dots: Shiba state,

Kondo effect vs superconductivity)

PROBABLE OBSERVATION OF THE JOSEPHSON SUPERCONDUCTING TUNNELING EFFECT

P. W. Anderson and J. M. Rowell
Bell Telephone Laboratories, Murray Hill, New Jersey
(Received 11 January 1963)

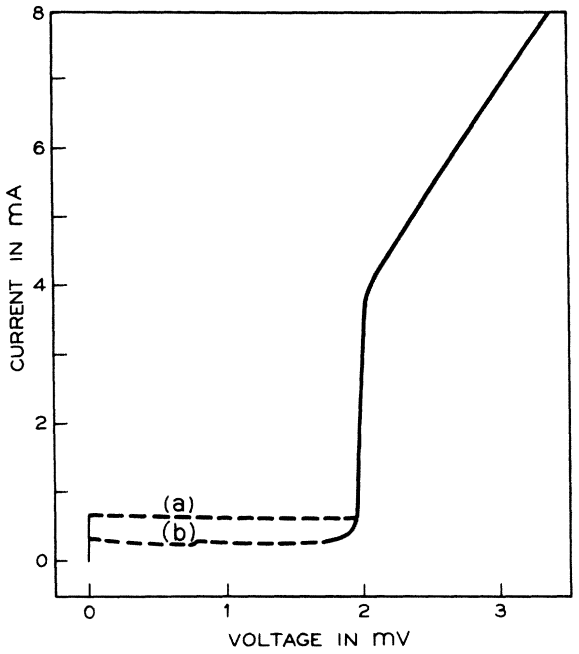
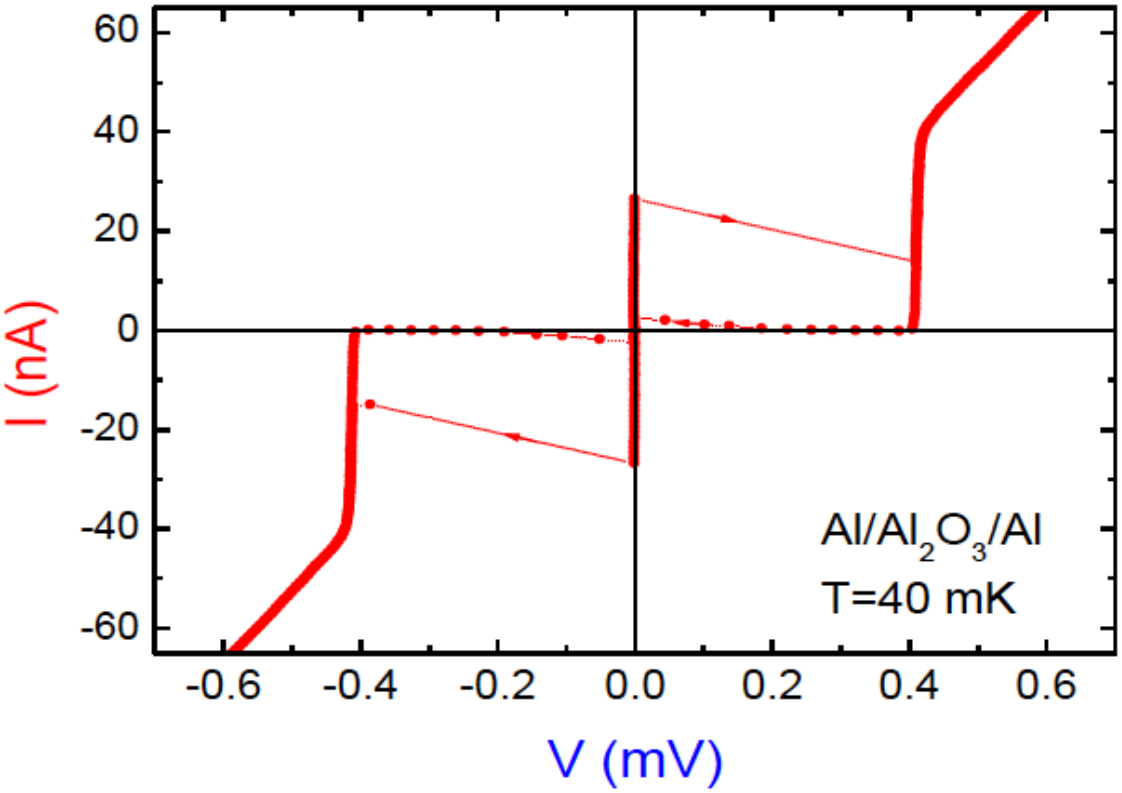


FIG. 1. Current-voltage characteristic for a tin-tin oxide-lead tunnel structure at ~1.5°K, (a) for a field of 6×10^{-3} gauss and (b) for a field 0.4 gauss.

IV characteristics of an SIS junction



MARs in superconducting atomic contacts

VOLUME 78, NUMBER 18 PHYSICAL REVIEW LETTERS 5 MAY 1997

Conduction Channel Transmissions of Atomic-Size Aluminum Contacts

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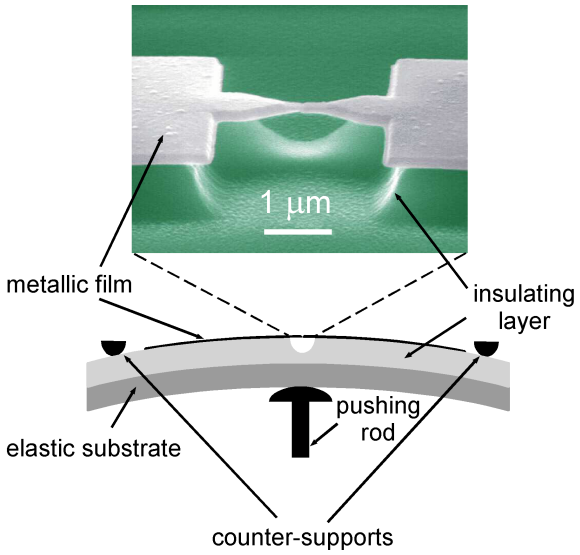
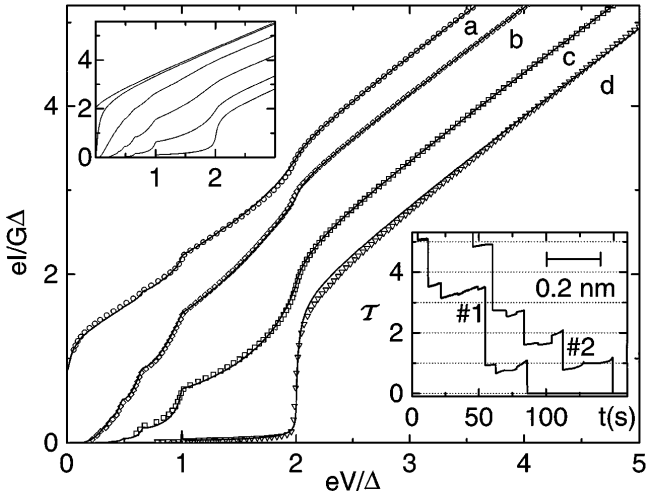
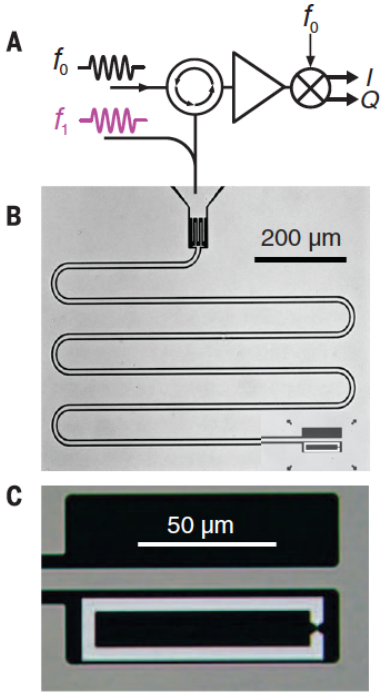
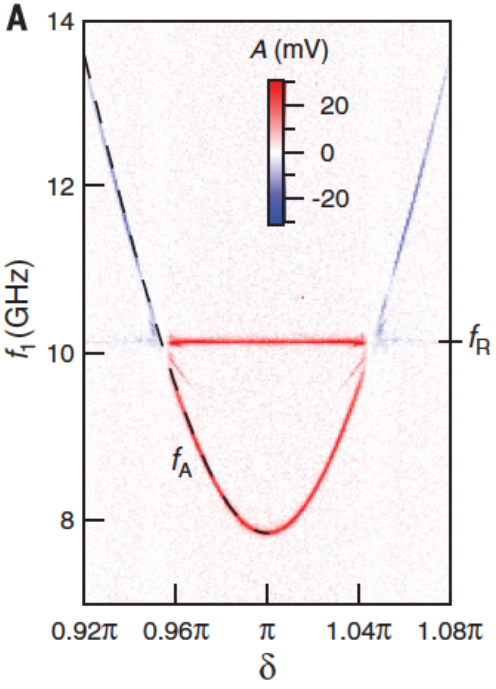
Service de Physique de l'Etat Condensé, Commissariat à l'Energie Atomique, Saclay, F-91191 Gif-sur-Yvette Cedex, France
(Received 4 February 1997)





Andreev qubit

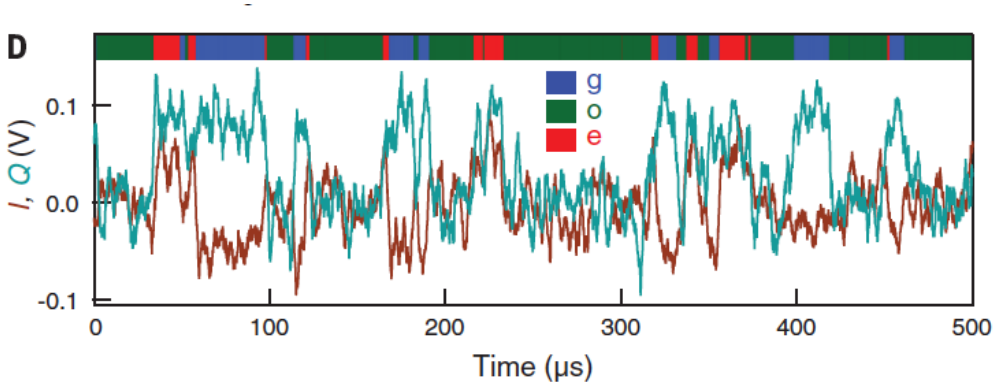




Coherent manipulation of Andreev states in superconducting atomic contacts

C. Janvier,[1] L. Tosi,[1,2] L. Bretheau,[1*] Ç. Ö. Girit,[1†] M. Stern,[1] P. Bertet,[1] P. Joyez,[1] D. Vion,[1] D. Esteve,[1] M. F. Goffman,[1] H. Pothier,[1] C. Urbina[1‡]

Science 349, 1199 (2015)



Andreev bound state in quantum dot

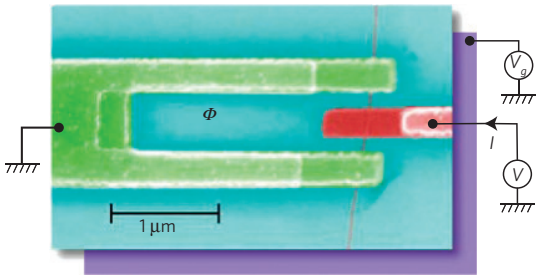
nature physics

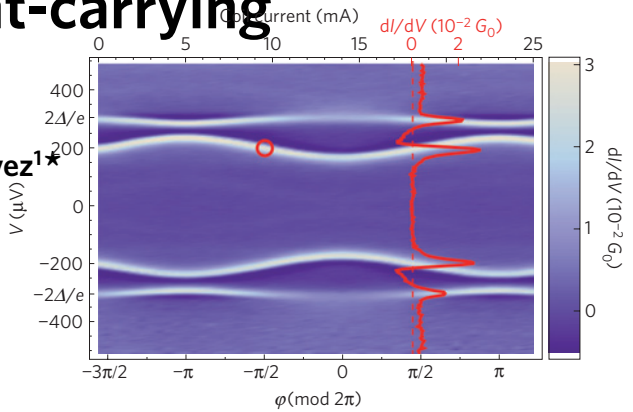
LETTERS

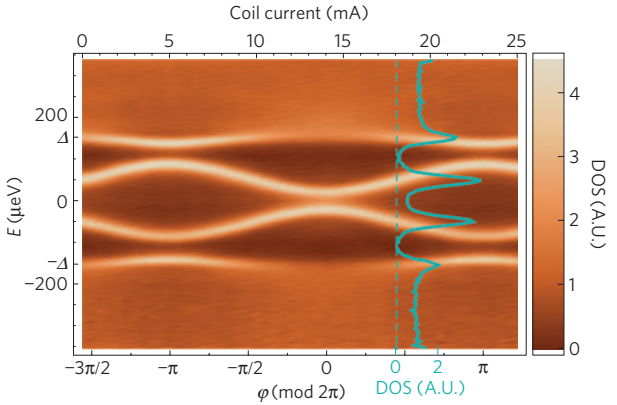
PUBLISHED ONLINE: 14 NOVEMBER 2010 | DOI: 10.1038/NPHYS1811

Andreev bound states in supercurrent-carrying carbon nanotubes revealed

J-D. Pillet[1], C. H. L. Quay[1†], P. Morfin[2], C. Bena[3,4], A. Levy Yeyati[5] and P. Joyez[1*]







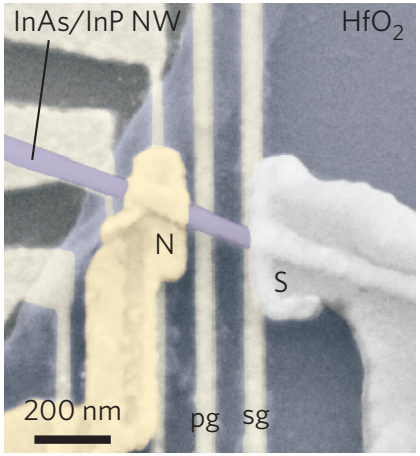
nature nanotechnology

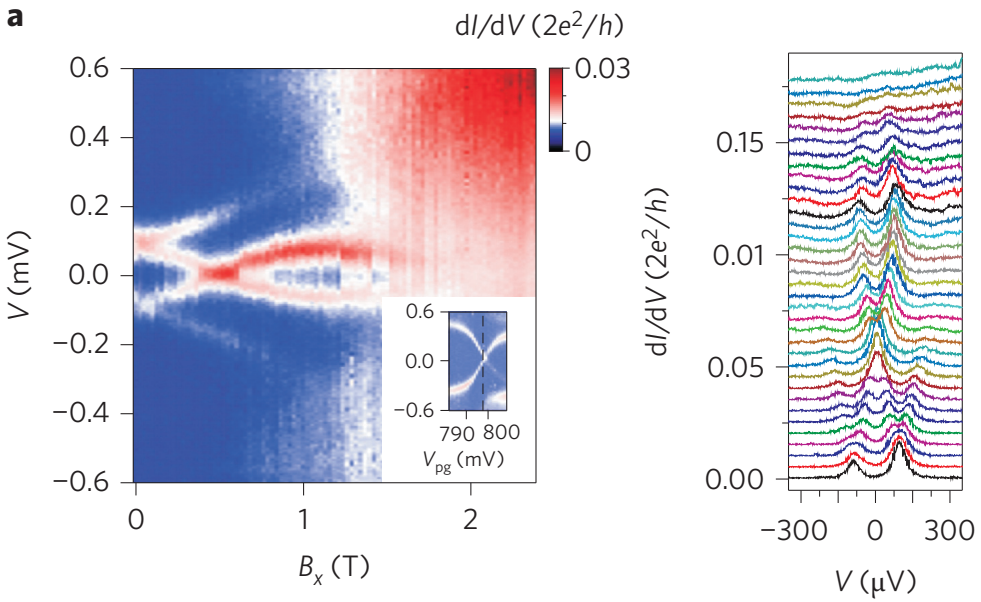
ARTICLES

PUBLISHED ONLINE: 15 DECEMBER 2013 | DOI: 10.1038/NNANO.2013.267

Spin-resolved Andreev levels and parity crossings in hybrid superconductor–semiconductor nanostructures

Eduardo J. H. Lee[1], Xiaocheng Jiang[2], Manuel Houzet[1], Ramón Aguado[3], Charles M. Lieber[2] and Silvano De Franceschi[1]*





First-Order 0-π Quantum Phase Transition in the Kondo Regime of a Superconducting Carbon-Nanotube Quantum Dot

Romain Maurand,[1] Tobias Meng,[2] Edgar Bonet,[1] Serge Florens,[1] Laëtitia Marty,[1,*] and Wolfgang Wernsdorfer[1]

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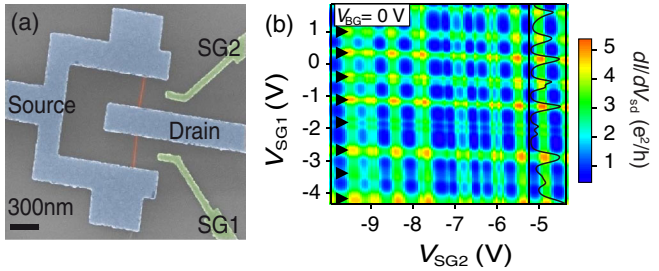
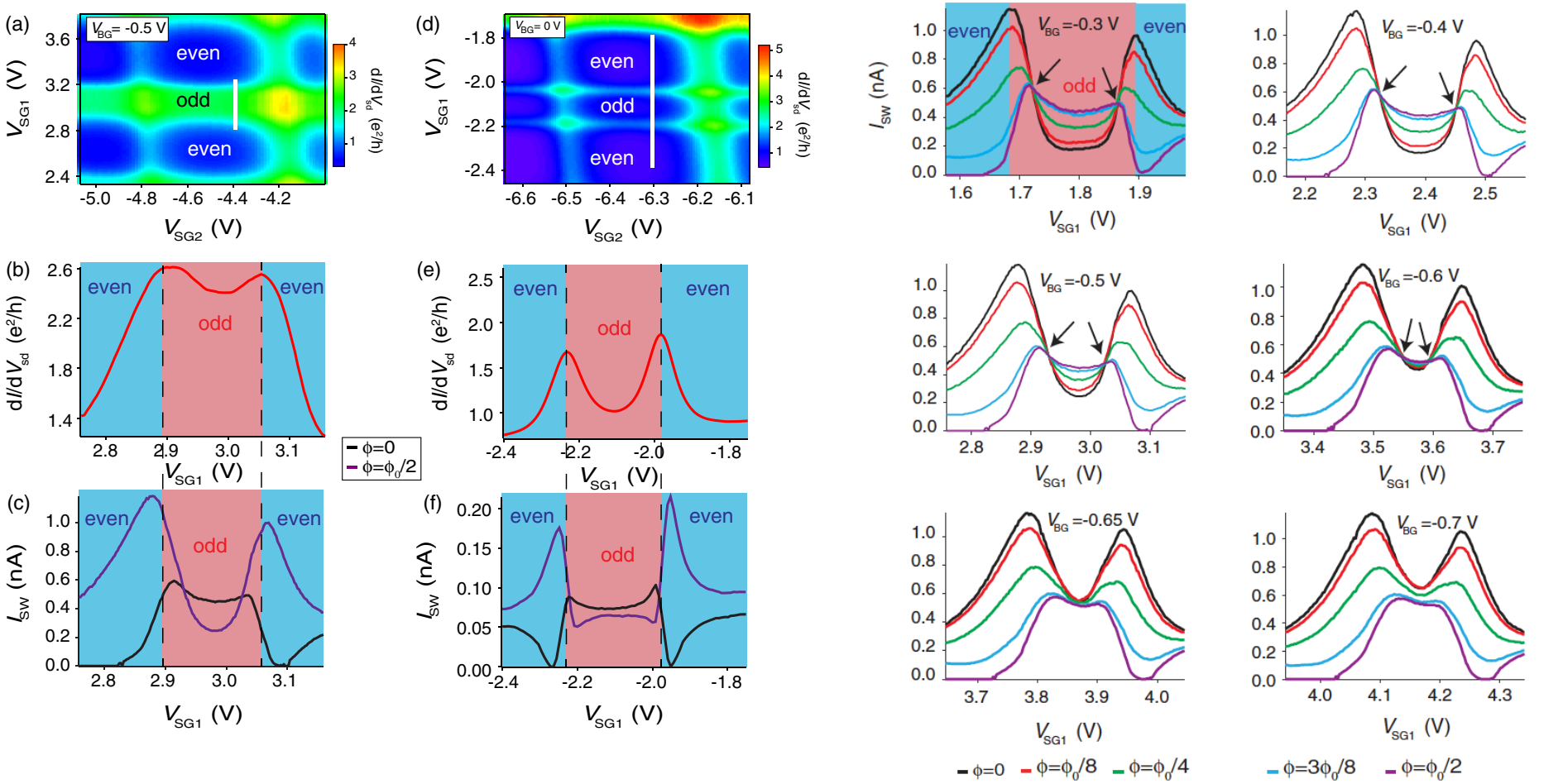
(Received 2 October 2011; published 15 February 2012; publisher error corrected 16 February 2012)





Shiba state

nature physics

LETTERS

PUBLISHED ONLINE: 12 OCTOBER 2015 | DOI: 10.1038/NPHYS3508

Coherent long-range magnetic bound states in a superconductor

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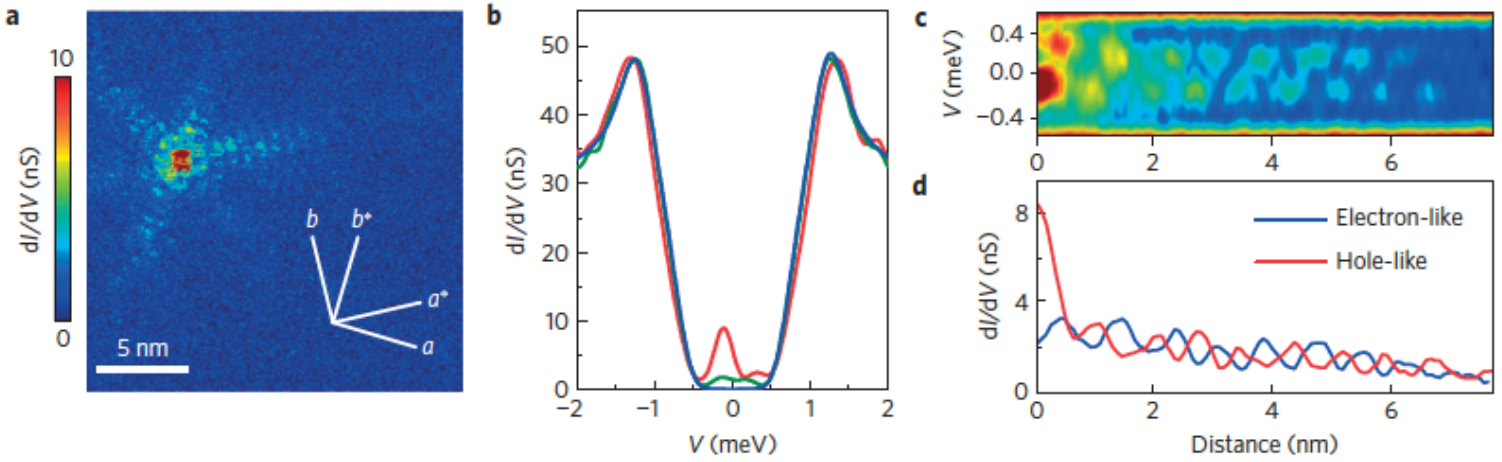

Figure 3 | Spectral and spatial properties of an extended Yu–Shiba–Rusinov bound state in 2H-$NbSe_2$. a, Experimental conductance map taken at −0.13 meV. The *a* and *b* lines indicate the crystallographic axes of 2H-$NbSe_2$, whereas the *a** and *b** lines indicate the directions in the reciprocal space. **b**, Characteristic experimental spectra taken on top of the impurity (red), on the right branch, 4 nm from the centre of the impurity (green), and far from the impurity (blue). **c**, Spatial and energy evolution of the experimental tunnelling conductance spectra, $dI/dV(x, V)$ along one branch of the star. The left side of the figure corresponds to the centre of the star and the right side to the top-right corner of the scanning area. The colour conductance scale is the same as that used in **a**. **d**, Conductance profiles of the electron- and hole-like YSR states as a function of the distance to the impurity along the same line as for **c**.