

**Electronic Supplementary Information**

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**Localised Nanoscale Resistive Switching in GaP Thin Films with Low Power Consumption**

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Keywords: gallium phosphide, thin film, resistive switching, grain boundary, AFM

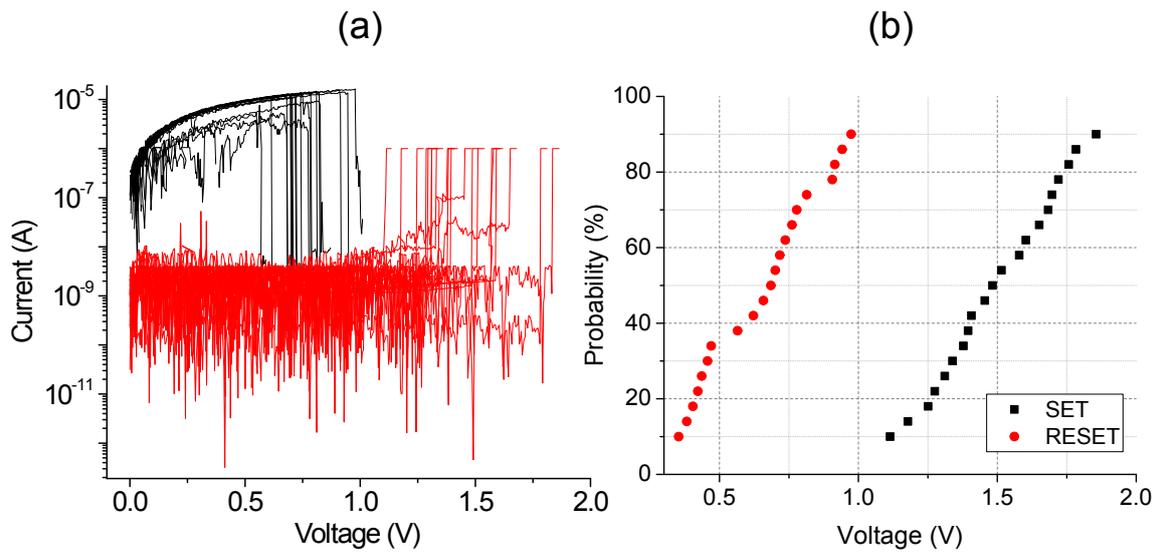


Fig. S1. (a) Repeatabile unipolar resistive switching over more than 20 cycles. (b) Cumulative probability of RESET and SET voltages.

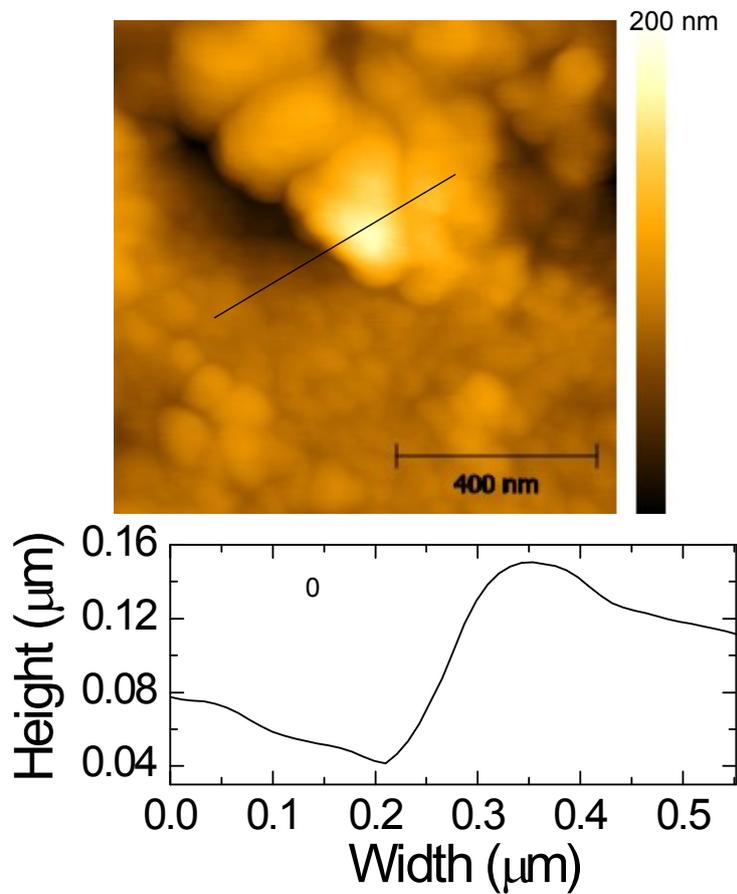


Fig. S2. AFM topography image and line profile, taken at the position indicated by the black line in the AFM image.

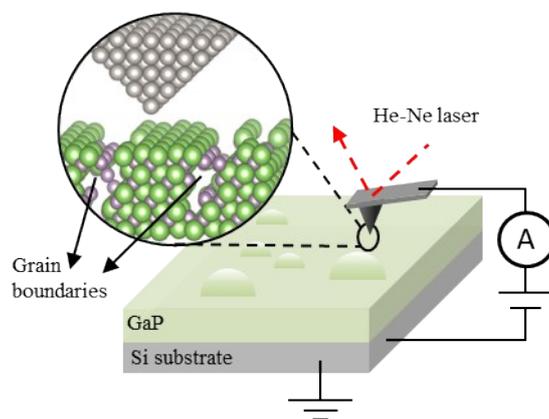


Fig. S3. Sample structure and cAFM measurement setup.

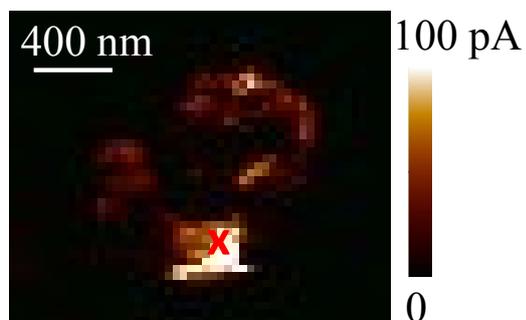


Fig. S4. Current distribution over an island of GaP. The red cross marks the tip position used for  $I$ - $V$  measurements.

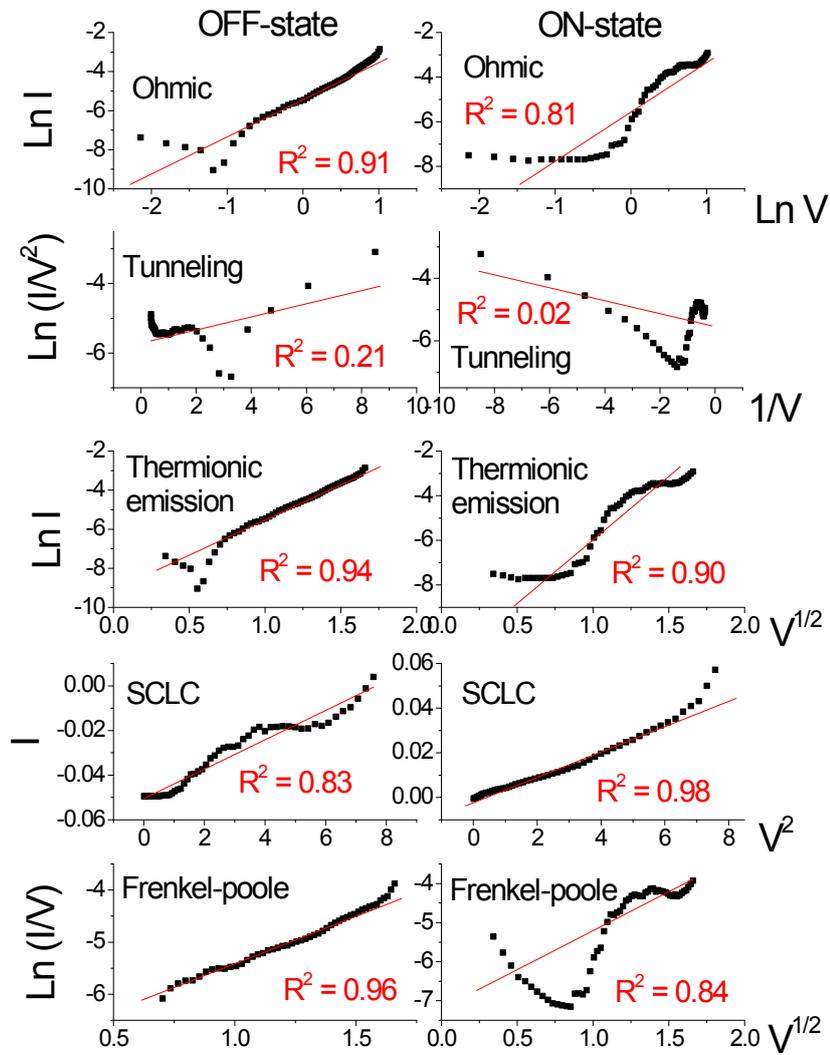


Fig. S5. Fitting of the  $I$ - $V$  curves using five different conduction mechanisms in both the ON- and OFF-states. The best fits are obtained with the Frenkel-Poole emission mechanism for the OFF-state and the SCLC mechanism for the ON-state.

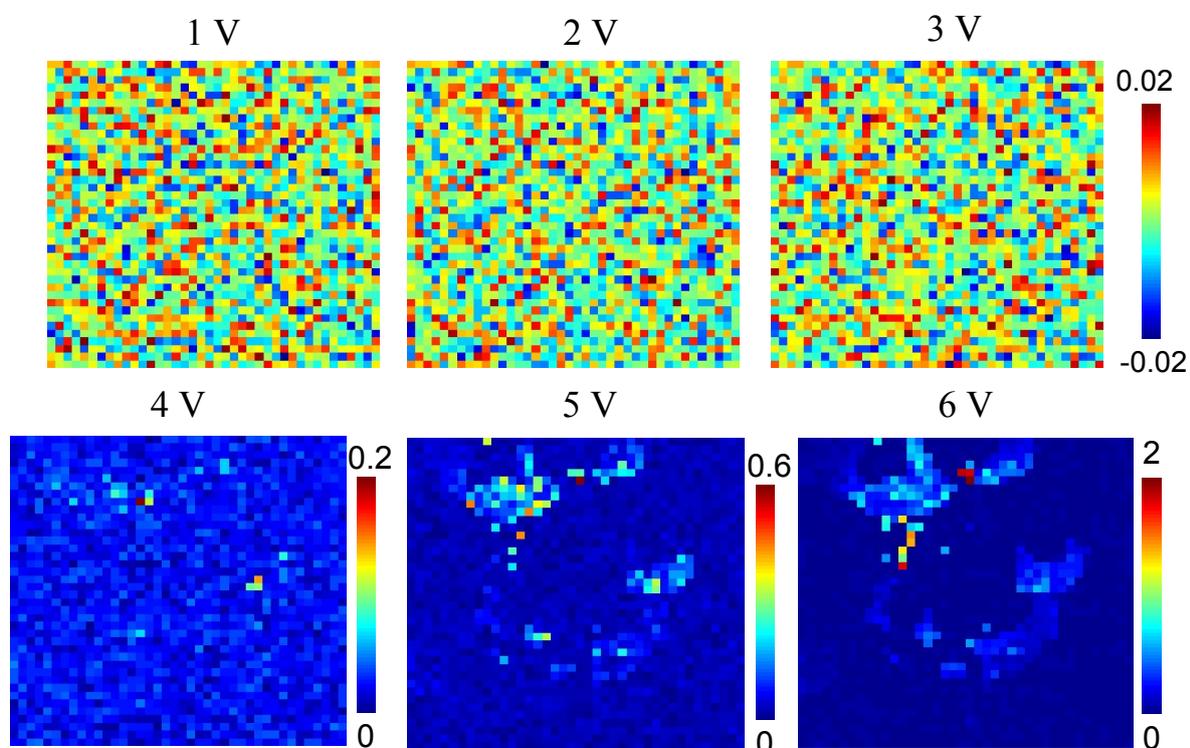


Fig. S6. Evolution of conduction map at the increasing bias voltage from 1 V to 6 V. The unit scale bar is in nA.

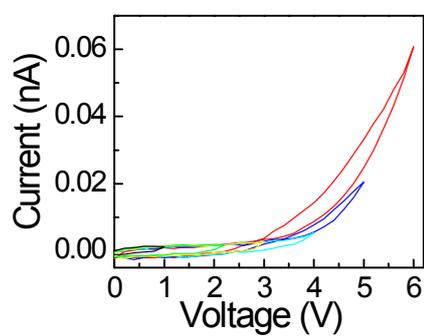


Fig. S7.  $I$ - $V$  switching cycles averaged from the entire region of interest in Fig. S5.

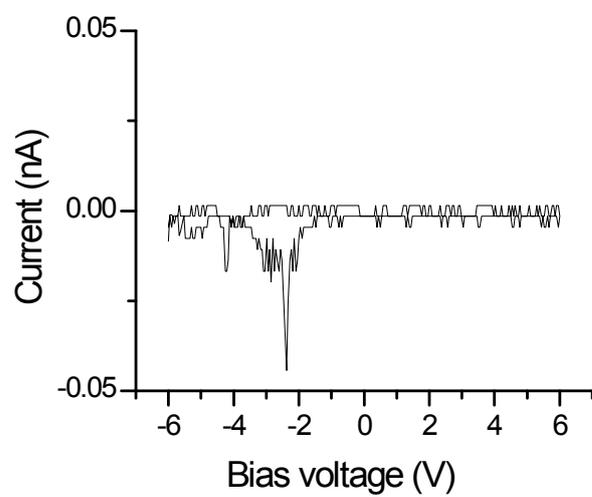


Fig. S8.  $I$ - $V$  characteristics of the GaP film in a well-ordered crystalline region of the film.