SUPPLEMENTARY INFORMATION

Fermi level position, Coulomb gap, and Dresselhaus splitting in (Ga,Mn)As

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1. Band assignment of GaAs and photoelectron matrix-element effect

We observed a strong selection rule of photoelectron intensity[40] (*i.e.* photoemission matrix-element effect) in the ARPES data of GaAs and (Ga,Mn)As. As displayed in Fig. S1**a**, when the polarization vector of monochromatized He-Iα resonance line points perpendicular to the measured $\overline{\Gamma \mathrm{X}}$ cut (see inset), both the light hole (LH) and heavy hole (HH) bands are well resolved, particularly in high binding-energy region, while the intensity of the split-off (SO) band appears to be very weak. On the other hand, when the polarization vector is aligned parallel to the $\overline{\Gamma \mathrm{X}}$ cut as shown in Fig. S1**b**, the SO band appear to be more visible, while the LH/HH bands become dimmer. This characteristic polarization dependence of ARPES intensity is consistent with the previous report of soft-x-ray ARPES on (Ga,Mn)As[23].

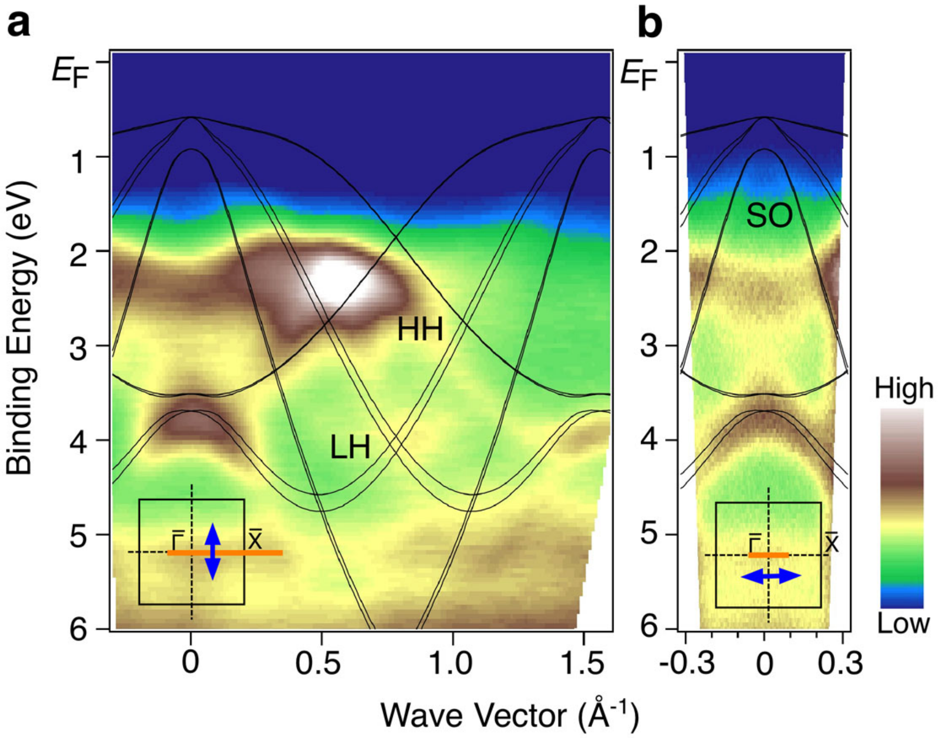

Figure S1 I Light-polarization dependence of ARPES intensity of GaAs. a, ARPES intensity of GaAs (n-type; Si-doped) measured along the ΓX̄ cut by setting the polarization vector of incident light perpendicular to the measured cut (see arrow in inset). **b**, ARPES intensity of GaAs measured with the polarization vector parallel to the measured cut (inset). Calculated band structure of GaAs within the tight-binding approximation (same as Fig. 1e) is overlaid by solid curves in **a** and **b**.