Observation of well-defined Kohn-anomaly in high-quality graphene devices at room temperature (Supplementary Information)

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Fig. S 1. **Device Pictures.** Micrograph of the (a) WS$_2$, (b) MoS$_2$, (c) WTe$_2$, (d) Au2, (e) Au3, and (f) Au4 devices.
Fig. S 2. **Comparing the transparency of devices.** (a-d) Raman spectra of the WS$_2$, MoS$_2$, and WTe$_2$ heterostructures, respectively. The TMD’s thickness is about 20-30 nm. The inset figures show sketches of the respective heterostructures. Panel (a) shows that WS$_2$ emit a significant photoluminescence tail at the graphene Raman peaks, where it obscures the G band observation. Although MoS$_2$ has some luminescence at graphene peaks, see panel (b), the G and 2D bands are clearly observed. In panel (c), data from FET with WTe$_2$ as a gate material is presented. There is no luminescence background, but data shows emissions from contaminants.
Fig. S 3. Au1 Raman Characterization. (a) G frequency, (b) G FWHM, (c) G intensity as a function of gate voltage for the Au1 device. (d) 2D frequency, (e) 2D FWHM, (f) 2D intensity as a function of gate voltage for the Au1 device.
Fig. S 4. Au3 Raman Characterization. (a) G frequency, (b) G FWHM, (c) G intensity as a function of gate voltage for the Au3 device. (d) 2D frequency, (e) 2D FWHM, (f) 2D intensity as a function of gate voltage for the Au3 device.
Fig. S 5. Au4 Raman Characterization. (a) G frequency, (b) G FWHM, (c) G intensity as a function of gate voltage for the Au4 device, first dataset. (d) 2D frequency, (e) 2D FWHM, (f) 2D intensity as a function of gate voltage for the Au4 device, first dataset.
Fig. S 6. **Au4 Raman Characterization.** (a) G frequency, (b) G FWHM, (c) G intensity as a function of gate voltage for the Au4 device, second dataset. (d) 2D frequency, (e) 2D FWHM, (f) 2D intensity as a function of gate voltage for the Au4 device, second dataset.
Fig. S 7. Leakage current of the Au1 device

Fig. S 8. AFM of the gold layer. (a) AFM image of the gold layer from Au1 device and, (b) a line profile. These measurements show that although the Au layer is 10 nm, it is uniform.