

Examples of low-dimensional systems:

2D

semiconductor heterostructures

molecular beam epitaxy (MBE)

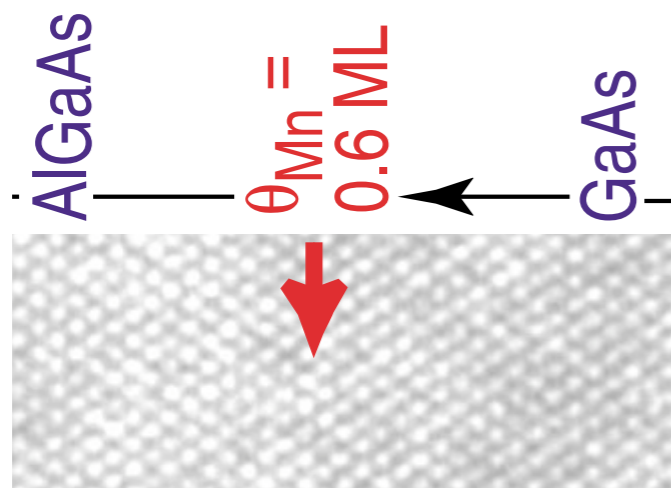
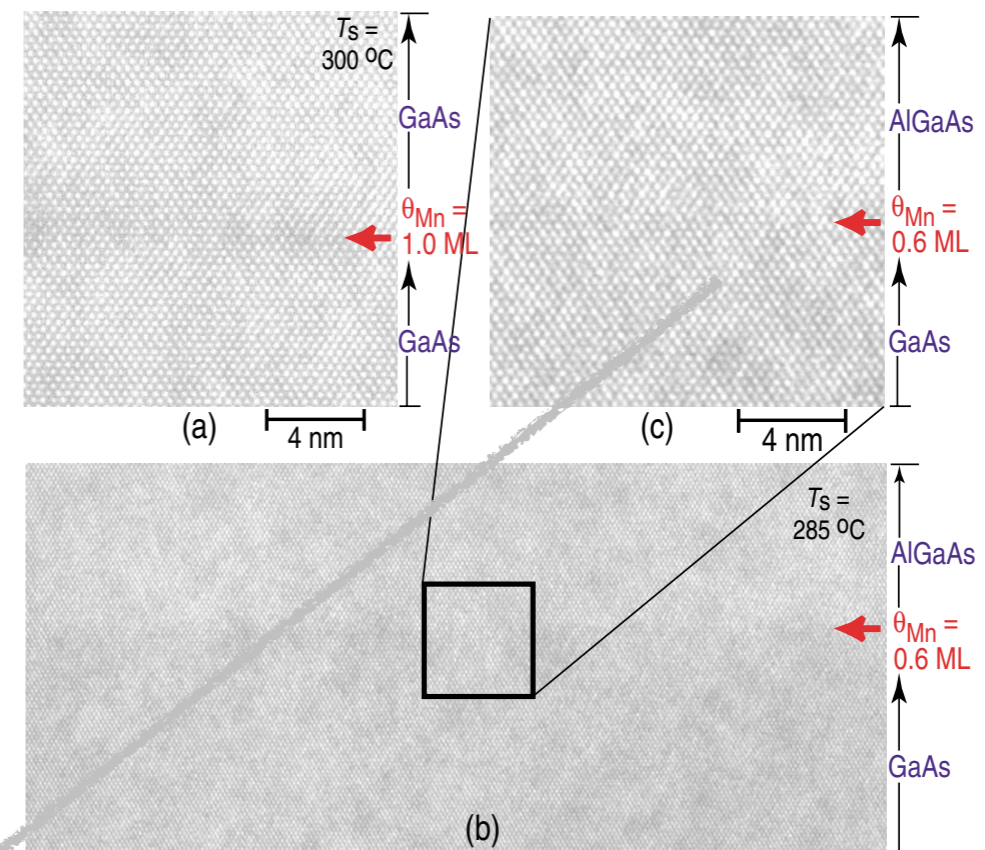
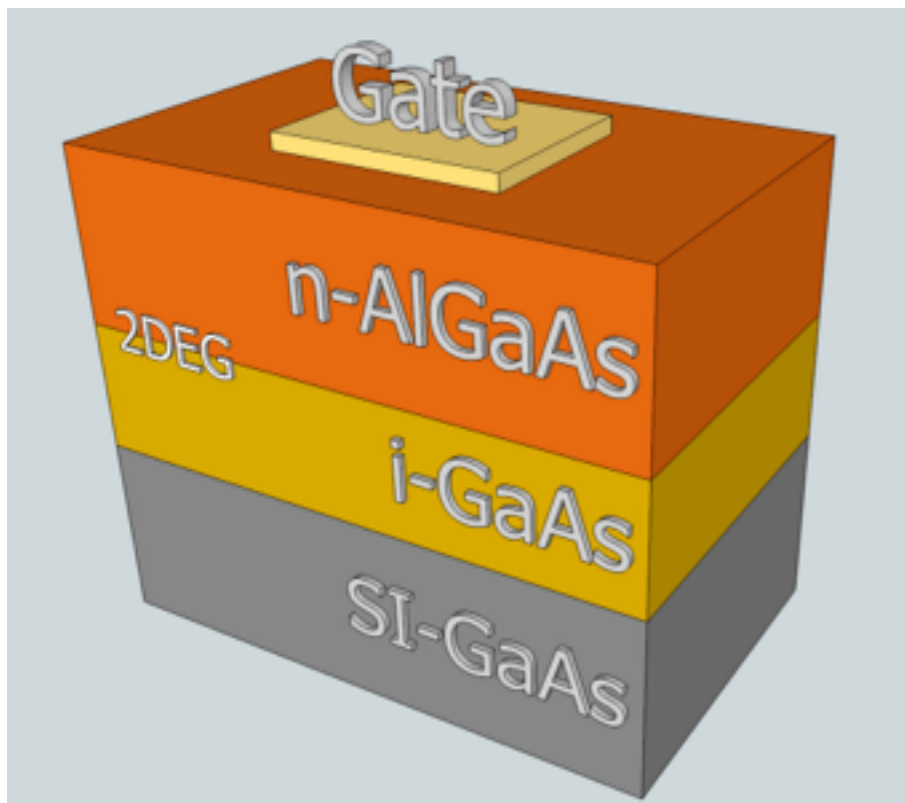
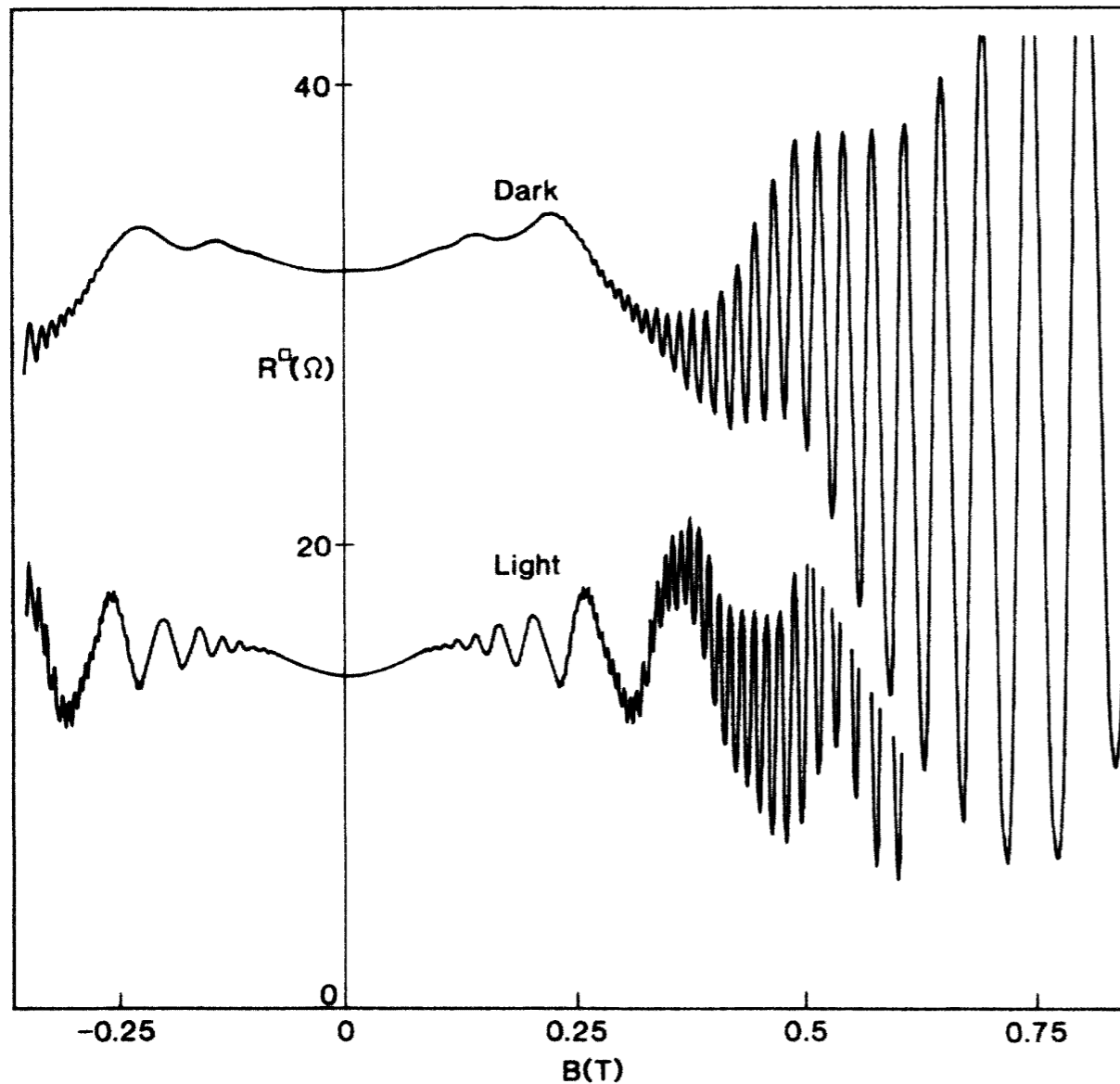


FIG. 2 (color). (a) Cross-sectional HRTEM lattice image of a 1.0 ML Mn δ -doped sheet in GaAs grown under the same conditions of sample A ($T_s = 300^\circ\text{C}$). The slightly dark area indicated by arrows corresponds to the Mn δ -doped sheet localized within a width of 2–3 ML. (b),(c) Cross-sectional HRTEM lattice image of the $\text{Al}_{0.3}\text{Ga}_{0.7}\text{As}/\text{GaAs}$ heterostructure with $\theta_{\text{Mn}} = 0.6$ ML (sample B: $T_s = 285^\circ\text{C}$). (c) is an enlarged image at the Mn δ -doped layer. There is no dislocation, no visible second phase or MnAs clusters, and the structure maintains the zinc-blende type crystal structure.

Quasi-2D character of electron gas:



- oscillating magnetoresistance
- positive dR/dB at low B
- Shubnikov-de Haas period

$$\Delta \left(\frac{1}{B} \right) \propto 1/n$$

FIG. 1. The resistance per square for a GaAs- $\text{Al}_x\text{Ga}_{1-x}\text{As}$ heterostructure with two two-dimensional subbands occupied as a function of magnetic field at 30 mK. Persistent photoconduction is used to change the carrier densities. The fast oscillations pertain to the lowest subband and the slow oscillations to the second subband.

