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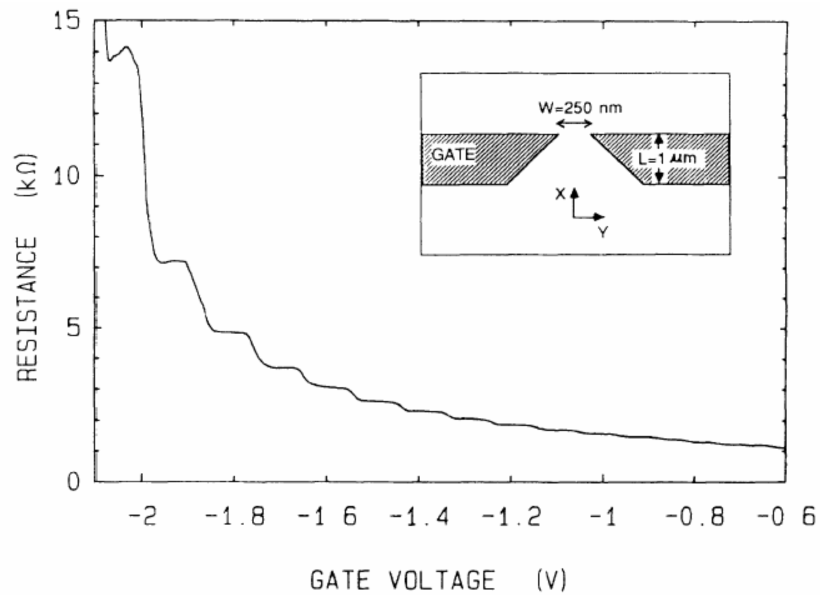
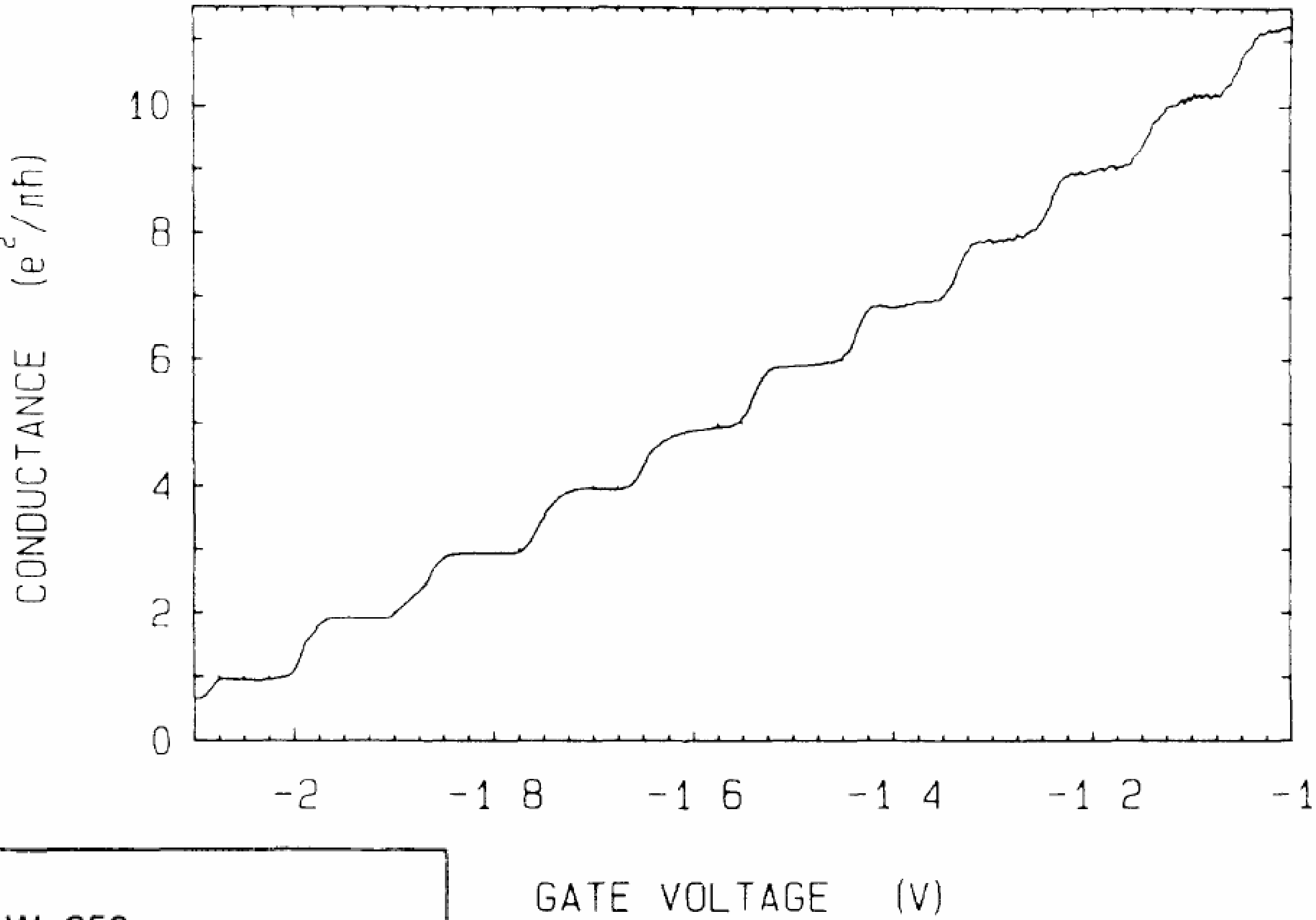
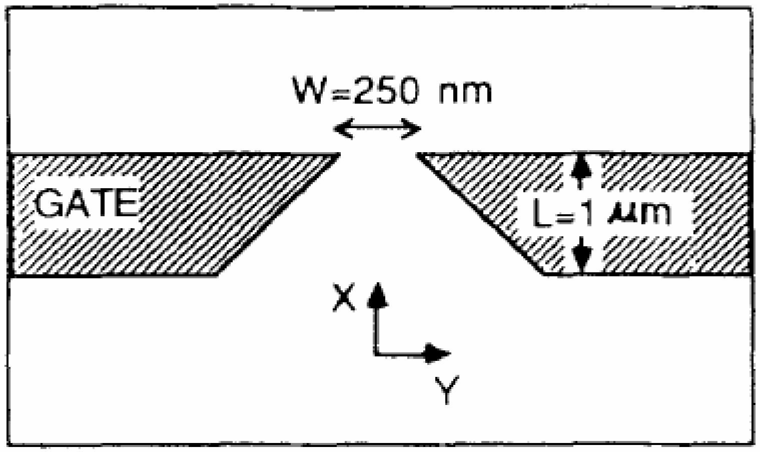




CONDUCTANCE (e^2/πħ)
0
2
4
6
8
10
-2
-1 8
-1 6
-1 4
-1 2
-1
GATE VOLTAGE (V)



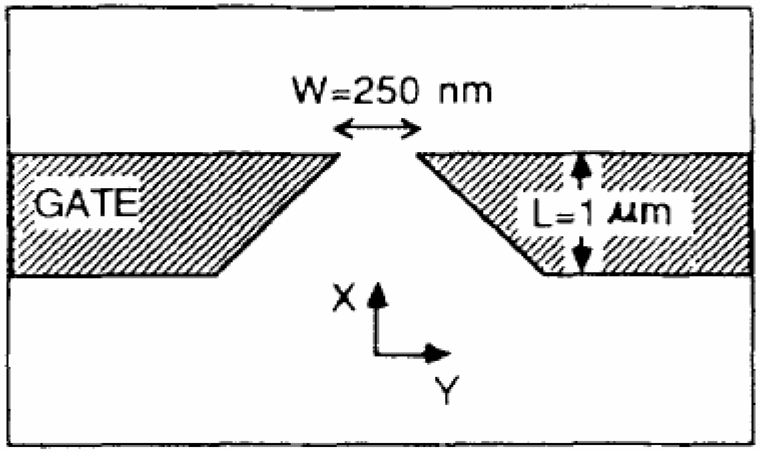
W=250 nm
GATE
L=1 μm
X
Y

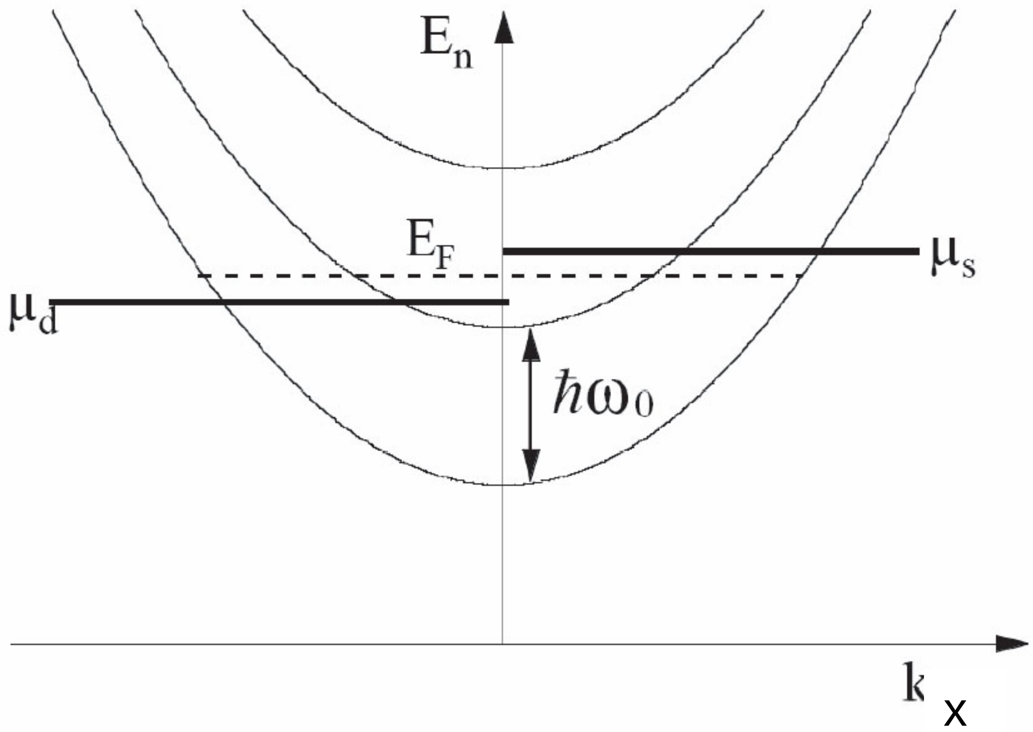
$$\left[\frac{\hbar^2k^2}{2m^*}+\frac{p_y^2}{2m^*}+\frac{1}{2}m^*\omega_0^2y^2\right]\chi(y)=\chi(y)$$

$$\chi_{n,k}(y) = u_n(q) \quad \text{where} \quad q=\sqrt{m^*\omega_0/\hbar}\,y$$

$$E(n,k) = \frac{\hbar^2k^2}{2m^*}+\left(n+\frac{1}{2}\right)\hbar\omega_c, \quad n=0,1,2,\ldots$$

$$v(n,k)=\frac{1}{\hbar}\frac{\partial E(n,k)}{\partial k}=\frac{\hbar k}{m^*}$$



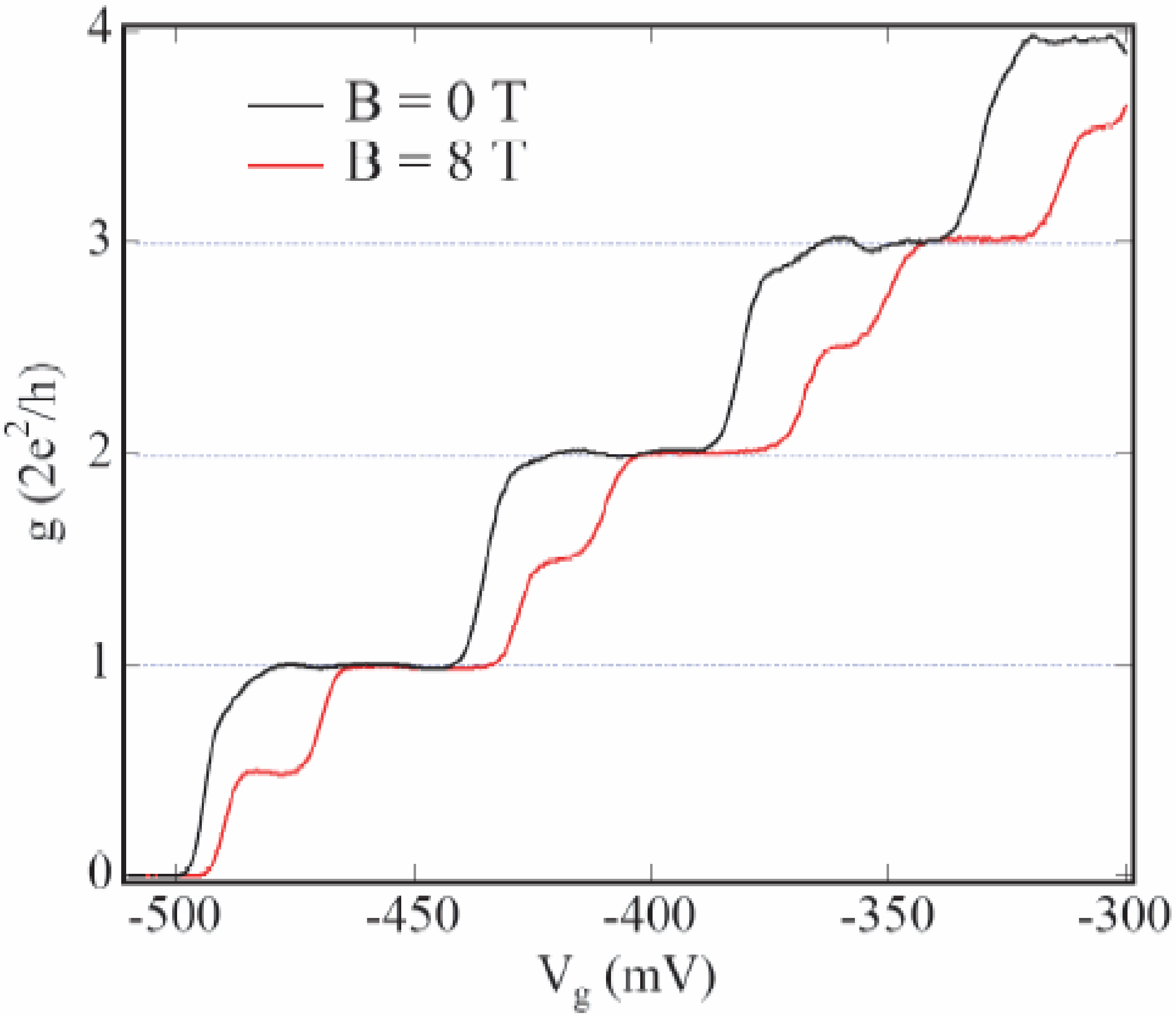


$$I = e \sum_{n=1}^{N} \int_{\mu_d}^{\mu_s} dE \frac{1}{2} \rho_n(E) v_n(E) T_n(E),$$

$$\begin{aligned} I &= e \sum_{n=1}^{N} \int_{\mu_d}^{\mu_s} dE \frac{1}{2} \frac{2}{\pi} \left(\frac{\partial E_n}{\partial k_x} \right)^{-1} \frac{1}{\hbar} \frac{\partial E_n}{\partial k_x} T_n(E_F) \\ &= \frac{2e}{h} \sum_{n=1}^{N} T_n(E_F) \int_{\mu_d}^{\mu_s} dE \\ &= \frac{2e}{h} \sum_{n=1}^{N} T_n(E_F) eV_{sd}. \end{aligned}$$

$$G = \frac{2e^2}{h} \sum_{n=1}^{N} T_n(E_F)$$

$$G = \frac{2e^2}{h} N,$$


B = 0 T
B = 8 T
4
3
2
1
0
g (2e²/h)
-500
-450
-400
-350
-300
V_g (mV)

3.7 Confined electrons in nonzero magnetic field

Finally, we consider the combination of both a confining potential and a magnetic field. We again write down the Schödinger equation:

$$\left[\frac{p_y^2}{2m^*} + \frac{(eBy + \hbar k)^2}{2m^*} + \frac{1}{2}m\omega_0^2 y^2\right]\chi(y) = E\chi(y) \tag{3.71}$$

It is easy to see that once again, this is basically a one-dimensional Schödinger equation with a parabolic potential and the eigenenergies and eigenfunctions look very similar to the results for electric and magnetic subbands:

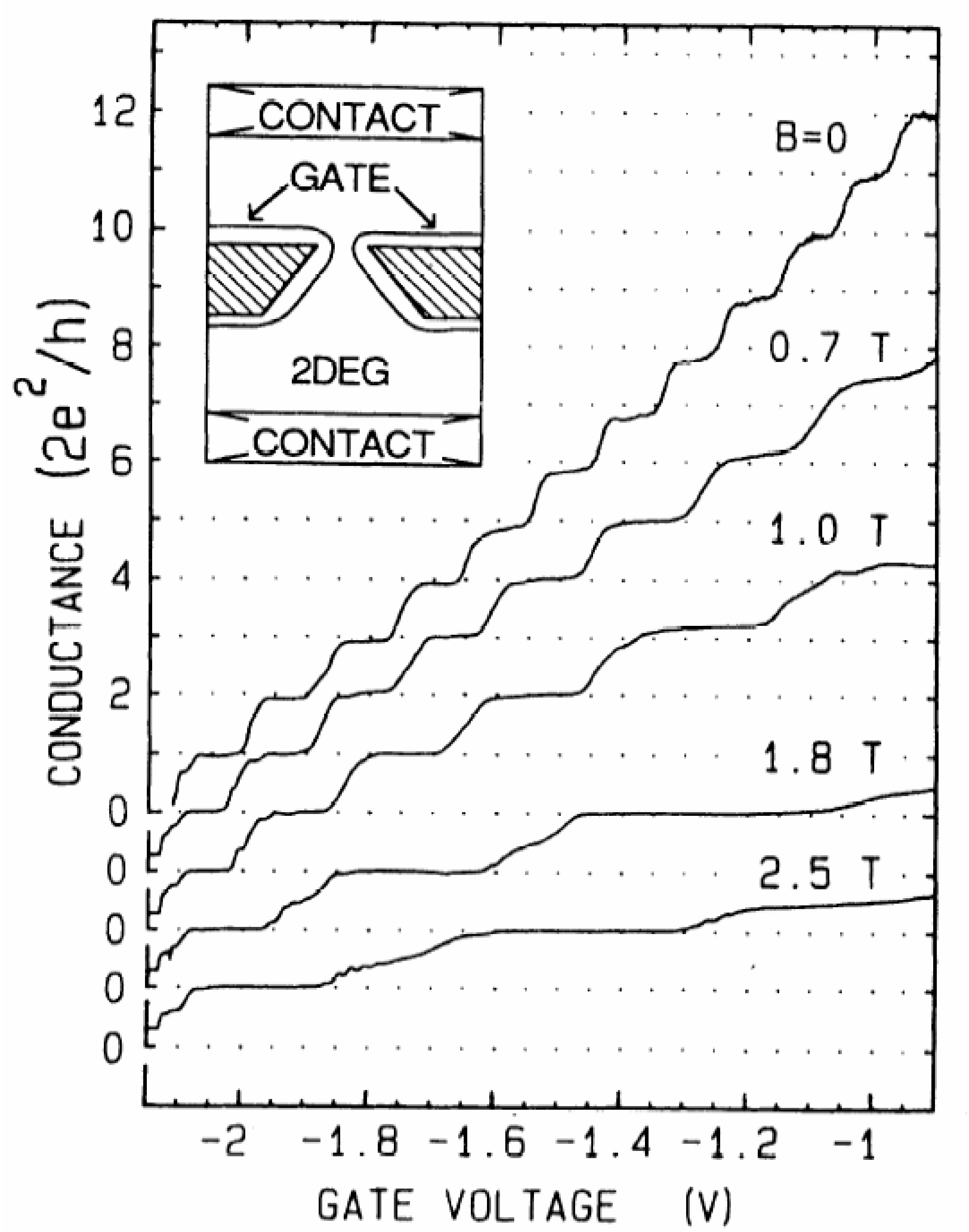
$$\chi_{n,k}(y) = u_n\left(q + \frac{\omega_c^2}{\omega_{co}^2} q_k\right) \tag{3.72}$$

where the electric and magnetic potentials now add in quadrature:

$$\omega_{c0}^2 = \omega_c^2 + \omega_0^2 \tag{3.73}$$

$$q = \sqrt{m^*\omega_{c0}/\hbar}\, y \quad \text{and} \quad q_k = \sqrt{m^*\omega_{c0}/\hbar}\, y_k, \quad y_k = \frac{\hbar k}{eB} \tag{3.74}$$

$$E(n,k) = \left(n + \frac{1}{2}\right)\hbar\omega_{c0} + \frac{\hbar^2 k^2}{2m^*}\frac{\omega_0^2}{\omega_{c0}^2}. \tag{3.75}$$



CONTACT
GATE
2DEG
CONTACT
B=0
0.7 T
1.0 T
1.8 T
2.5 T
12
10
8
6
4
2
0
0
0
0
0
CONDUCTANCE (2e²/h)
-2
-1.8
-1.6
-1.4
-1.2
-1
GATE VOLTAGE (V)

Low-Temperature Fate of the 0.7 Structure in a Point Contact: A Kondo-like Correlated State in an Open System

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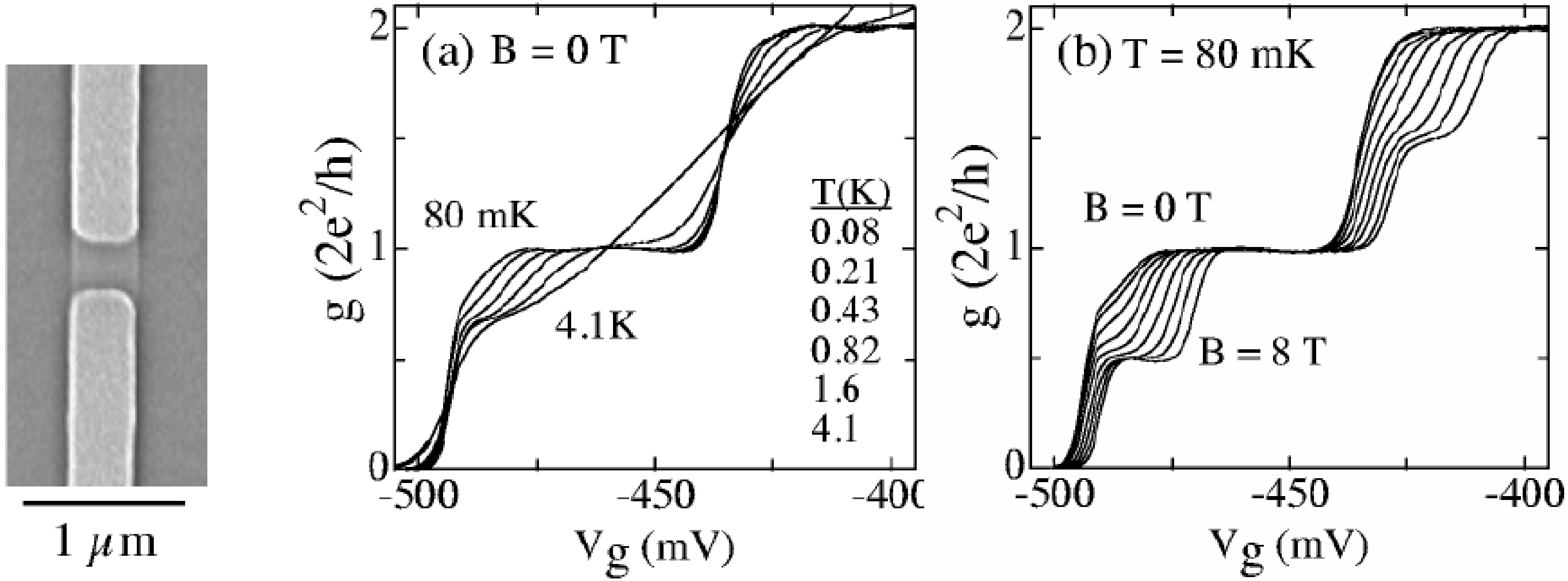
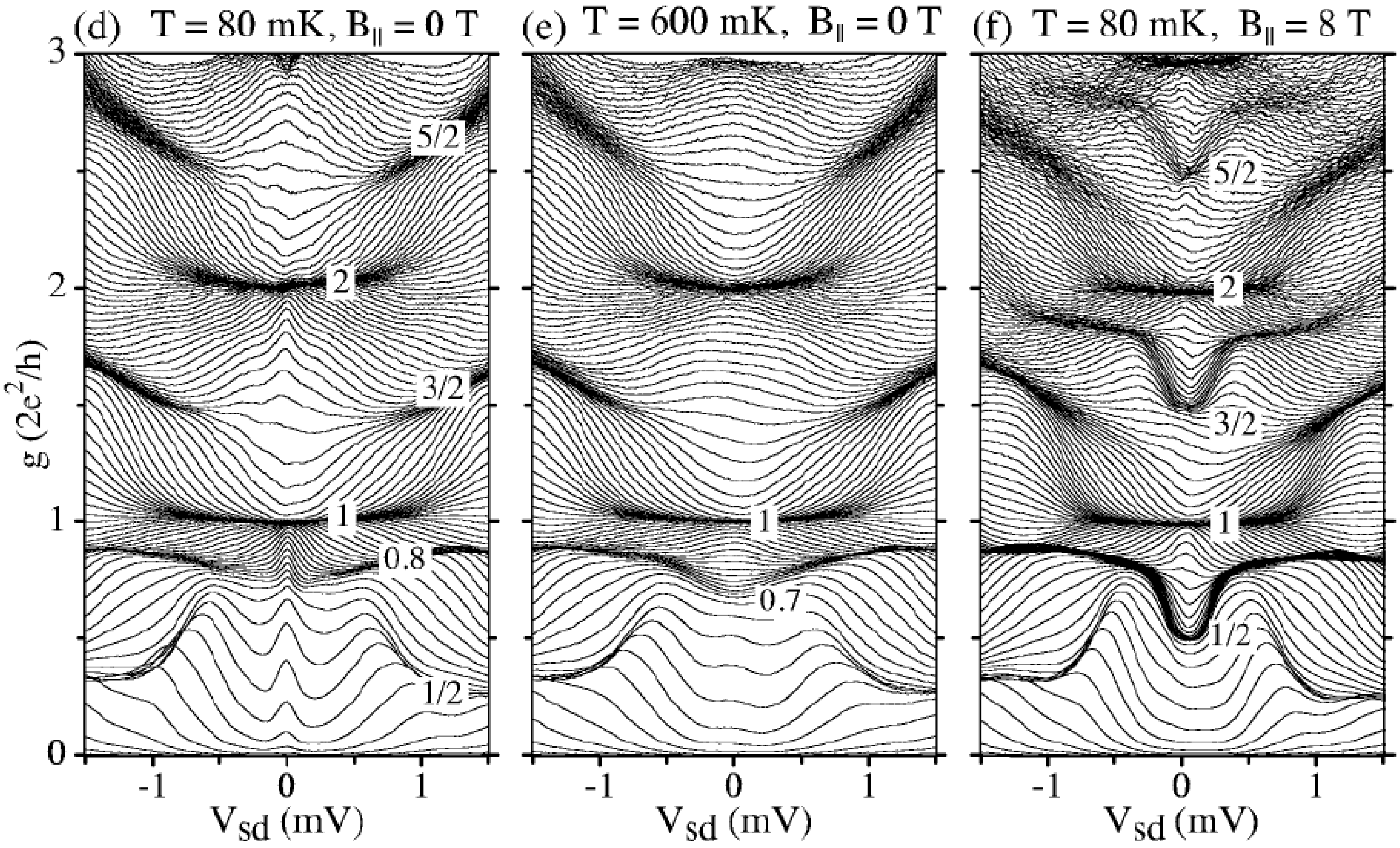
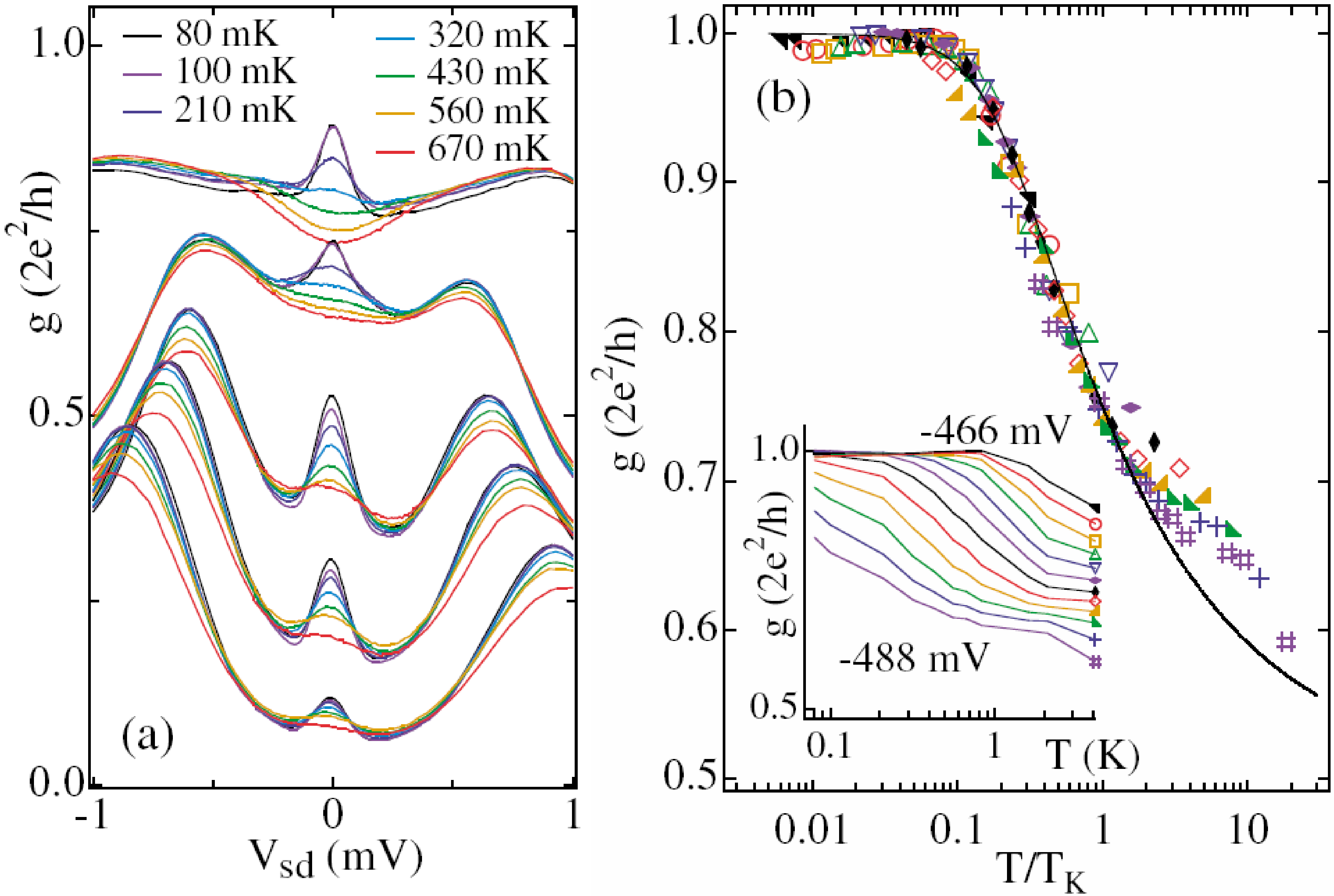



(d) T = 80 mK, B∥ = 0 T
(e) T = 600 mK, B∥ = 0 T
(f) T = 80 mK, B∥ = 8 T
g (2e²/h)
3
2
1
0
5/2
2
3/2
1
0.8
0.7
1/2
-1
0
1
Vsd (mV)


80 mK
100 mK
210 mK
320 mK
430 mK
560 mK
670 mK
(a)
g (2e²/h)
1.0
0.5
0.0
-1
0
1
Vsd (mV)
(b)
g (2e²/h)
1.0
0.9
0.8
0.7
0.6
0.5
0.01
0.1
1
10
T/TK
-466 mV
-488 mV
g (2e²/h)
1.0
0.5
0.1
1
T (K)