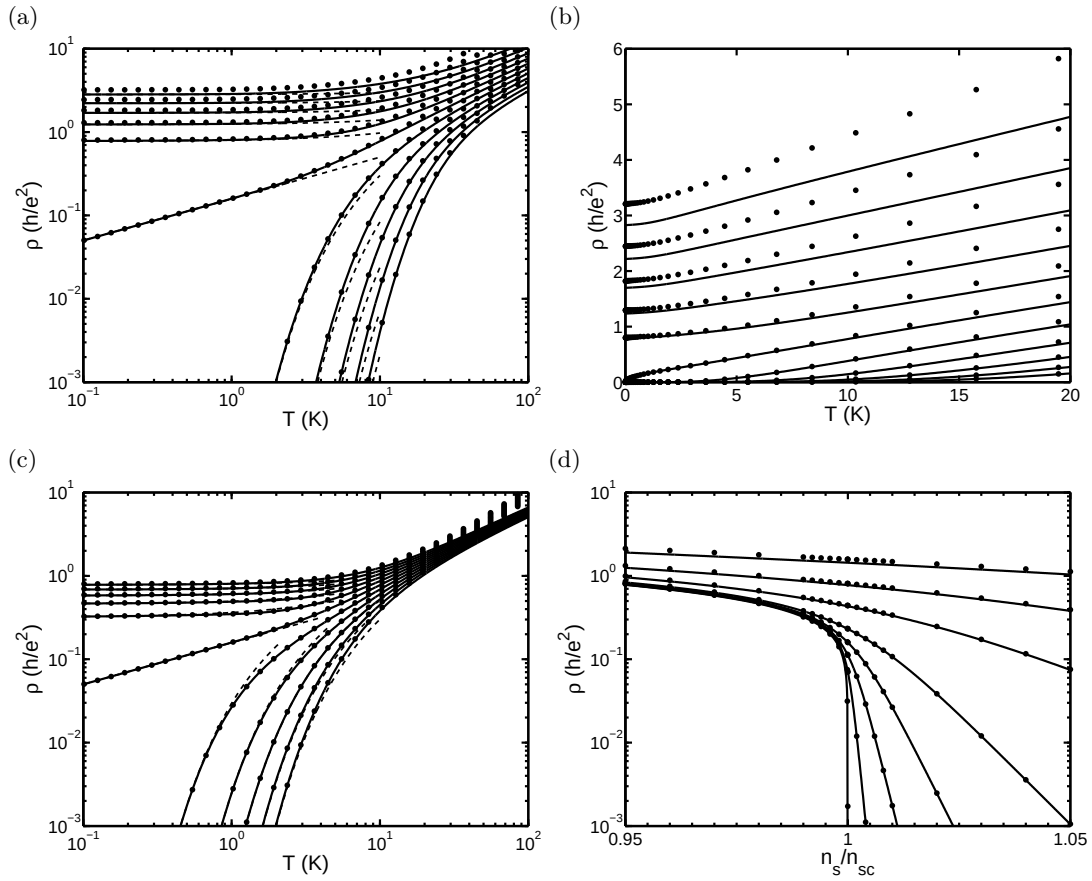

Figure 6. Behavior of the resistivity ρ depending on the temperature T and the 2D electron density in the inversion layer n_s. Full lines: saddle-point approximation, point symbols: numerical integration, dashed lines: low temperature approximations. On the curves in a) - c) n_s and in d) T is constant. Critical density $n_{sc} = 10^{11}\,\mathrm{cm}^{-2}$. a) logarithmic and b) linear display of $\rho(T)$ with parameters: $n_s = 0.75, \ldots, 1.25 \times n_{sc}$ in steps of $0.05 \times n_{sc}$ in top down order for the individual curves, c) logarithmic view of $\rho(T)$ with top down parameters: $n_s = 0.95, \ldots, 1.05 \times n_{sc}$ in steps of $0.01 \times n_{sc}$, d) $\rho(n_s)$ with parameters $T = 0$, 0.2, 0.5, 1, 2, 5, 10, 20 K in bottom up order.

and Stern (AFS)[28] and neglect the exchange interaction and correlation effects and use the Ritz variational principle. (In the mentioned article also more sophisticated methods for the calculation of ε_0 are given.)

For convenience we introduce a new coordinate system $z = -Z$, i. e. the z-axis is perpendicular to the OS interface, positive z-values correspond with the semiconductor side. For the electrons in the inversion layer the bent conduction band of the semiconductor together with the step at the interface builds the quantum well. We use the Fang-Howard envelope wave function according to AFS[34]

$$\varphi(z,b) = \begin{cases} \sqrt{\frac{b^3}{2}}\, z \exp\left(-\frac{bz}{2}\right) & \text{for } z \geq 0 \\ 0 & \text{for } z < 0. \end{cases} \qquad (48)$$

The parameter b is varied in order to make the total energy per electron minimal. For the potential several approximations are taken, see App. B for details.

In Fig. 7 the ground state energy ε_0 versus the electron density n_s is shown, ε_0 decreases with decreasing n_s. Now we hold the difference between trap energy and conduction band edge at the interface $\varepsilon_{TsCs} = E_{Ts} - E_{Cs} = E_{Ts} - \mu + \mu_{E_0} + \varepsilon_0$ constant (instead of ε_{Ts0} as before).

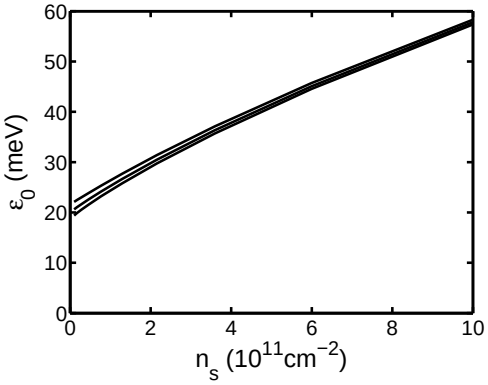

Figure 7. Ground state energy of the inversion layer ε_0 versus the density of electrons in the inversion layer n_s for three temperatures, top-down: $T = 0, 200, 300\,K$.