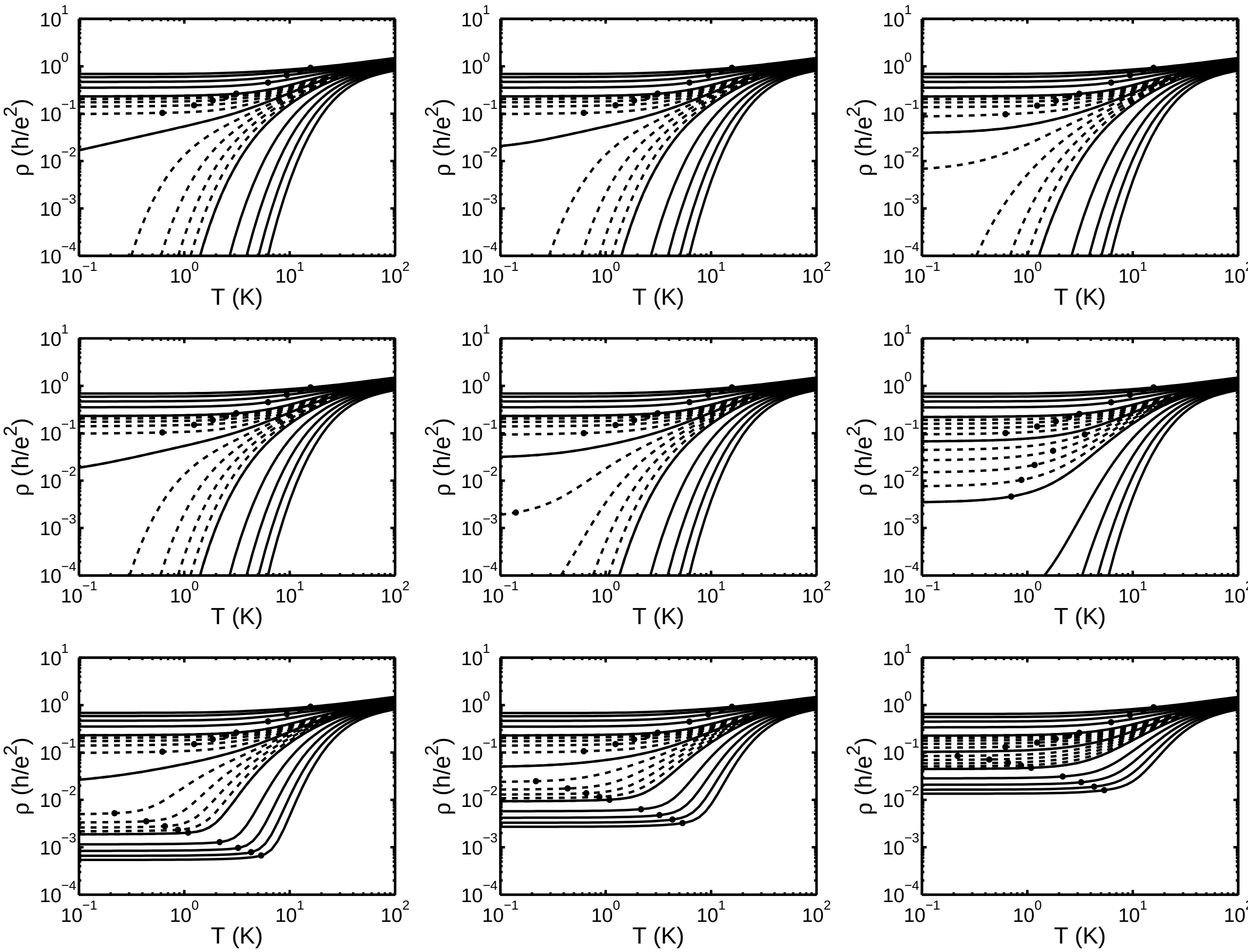

Figure 10. Resistivity $\rho\,(T, n_s)$ for different types of trap energy broadening functions and different width ΔE_T. The picture columns show uniform distribution, normal distribution, Lorentz distribution from top to bottom. The rows show energy width of $\Delta E_T = 0.02$, 0.1, 0.5 meV from left to right. For the curves n_s is constant. The critical density is $n_{sc} = 10^{11}\,\mathrm{cm}^{-2}$ for $\varepsilon_{TsCs} \simeq 95.7\,\mathrm{meV}$. Full lines show $n_s = 0.75, \ldots, 1.25 \times n_{sc}$ in steps of $0.05 \times n_{sc}$, dashed lines: $n_s = 0.96, \ldots, 1.04 \times n_{sc}$ in steps of $0.01 \times n_{sc}$ (from top to bottom), for a 3D trap density of $N_T = n_T/Z_{\max} = 10^{18}\,\mathrm{cm}^{-3}$.

Furthermore, the quantum corrections in the weak and strong localization regime are also neglected here, but would finally increase the resistance ρ at low T.

In addition, we have further generalized the dipole trap model by dropping the assumptions that the trap states are homogeneously distributed inside the oxide layer and that the energy distribution is δ-like. A narrow spatial distribution of the trap states near the oxide-semiconductor interface limits the number of charged states at high temperatures and thus gives an upper limit for the increase of the resistivity ρ as well. This leads to a good agreement with experimental observations at higher temperatures. The energetic broadening of the trap states on the other hand leads to a finite amount of unoccupied and thus charged states in cases where otherwise all states would lie below the chemical potential μ and the number of charged trap states would go to zero for $k_BT \to 0$. Thus for high electron densities with metallic behavior the resistivity will not further decrease towards lower temperature, but saturate at a finite values, as has been observed in experiments on Si-MOS structures as well.

The effect of a magnetic field can be taken into account by the Zeeman splitting of the trap states with spin $\pm 1/2$. As shown by Althuler and Maslov, the energetic splitting can turn a metallic behavior into an insulating one. We did not include magnetic field effect in our calculations, but an according energetic shift of the trap states has to lead to the same effects in our refined model as well.

We also like to mention that for low electron densities care has to be taken for the dipol scattering model. It is assumed that the electrons in the two-dimensional layer shield the potential of the charged trap states and thus form together a dipol field which is responsible for the