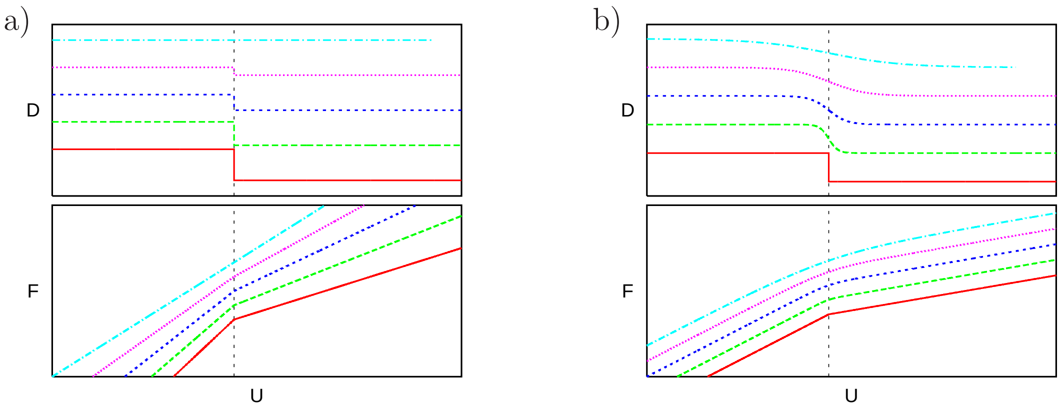

Figure 3.56: Scenarios for the ending of a first-order line: **a)** Upon approaching the end point (from bottom to top), the jump in the derivative of F (i.e., the jump in D) decays to zero; at the end point, the transition is of second order. **b)** Abrupt resolution of the kink in F or discontinuity in D (bottom lines) into a crossover region (broadening towards the top line).

sufficiently strong frustration the maximum Néel temperature T_N^{max} becomes lower than the critical temperature T^* of the fully frustrated model. Then, a paramagnetic first-order MIT takes place at least for $T_N^{max} \leq T < T^*$. Assuming a smooth curve $T_N(U)$ leads to a phase diagram as shown in Fig. 3.55 c. However, the energy difference on the MIT line between metallic and insulating solution is then still finite when reaching the second order line towards AF order, i.e., the Néel temperature. Thus, the first-order line cannot simply stop at this point. While the abrupt evolution of a first-order line into a crossover region (the width of which decays to zero towards the end point) as shown in Fig. 3.56 b appears to be thermodynamically consistent, such a scenario requires an abrupt change in D for at least one (here: both) of the solutions at the end point. This, in turn, implies a change of order one in the corresponding solution $G(i\omega_n)$ upon an infinitesimal variation of U and/or T which violates the assumptions of a Ginzburg-Landau theory (cf. subsection 3.7.1). Consequently, we will discard this possibility. In contrast, the crossing of a first-order MIT line with a smooth Néel curve as shown in Fig. 3.56 d is a priori possible.

However, the Néel curve of transitions between paramagnetic and AF phases cannot be assumed to be a smooth, continuous function $T_N(U)$ at a first metal-insulator transition. This follows from the fact that there are no precursor effects of magnetic order within the DMFT. Consequently, the antiferromagnetic susceptibility is determined by local properties of the homogeneous phase alone. Since the metallic and insulating phases are fundamentally different at the MIT and correspond to different fixed points of the self-consistency equations, it is hardly conceivable that the antiferromagnetic susceptibility diverges in both phases for exactly the same temperature T [on the MIT line $U_c(T)$]. As a result, we must expect a discontinuity (at least of the first derivative) or a non-uniqueness of the function $T_N(U)$ at the MIT as shown in Fig. 3.56 e and Fig. 3.56 f. In the insulating phase, D is smaller so that