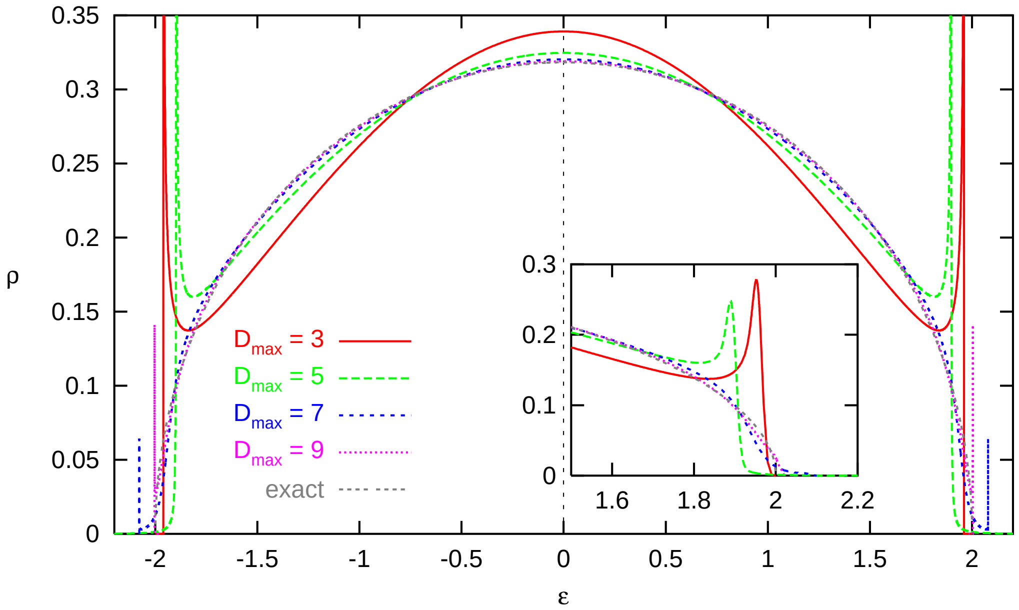

Figure 2.19: DOS for the tight-binding model truncated at different maximum hopping range $D_{\max}$ compared with the semi-elliptic DOS of the full model. Inset: same curves, broadened by a Gaussian of width 0.01.

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the hc DOS at high energies (about 4.6% for $|\epsilon| > 2$ and 0.3% for $|\epsilon| > 3$, respectively), the high-energy part of the transformation function becomes quantitatively irrelevant. In Fig. 2.18 a, the truncation error is seen to be small already in the relevant range of low and intermediate energies for 5^{th} order and almost invisible for 9^{th} order. Therefore, we may also expect good overall agreement on the level of the DOS for the truncated model. Note, however, that truncated transformation functions need not, in general, be monotonic; they have extrema for $D_{\max} = 3, 7, 9$ while the transformation function for $D_{\max} = 5$ is very close to a saddle point (see derivatives $\mathcal{F}'(\tilde{\epsilon})$ shown in Fig. 2.18 b). Thus, on the level of the DOS, the truncation error will be large pointwise near the resulting singularities even though the associated weight is small.

This is exactly what is seen in in Fig. 2.19: the DOS of the truncated model becomes singular at the band edges with rapidly decreasing weight for increasing $D_{\max}$. The good overall agreement with a semi-elliptic form can be further improved for $D_{\max} = 7$ and $D_{\max} = 9$ by broadening the curves with a Gaussian of width 0.01 in order to mimic the effect of a finite imaginary part of the self-energy caused by interactions (see inset). Thus, practical DMFT calculations should not be able to distinguish between a Bethe DOS and our model, truncated at $D_{\max} \geq 9$. As we will see below, the effects of truncation are even less severe when the model is applied in finite dimensions. Note that in the symmetric case and for a monotonic transformation function (i.e., when $\mathcal{F}(0) = 0$), the DOS at the symmetry point is