Curvature controlled wetting in two dimensions

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A complete wetting transition at vanishing curvature of the substrate in two-dimensional circular geometry is studied by the transfer matrix method. We find an exact formal mapping of the partition function of the problem onto that of a (1+1)-dimensional wetting problem in planar geometry. As the radius of the substrate $r_0 \to \infty$, the leading effect of the curvature is adding the Laplace pressure $\Pi_L \propto r_0^{-1}$ to the pressure balance in the film. At temperatures and pressures under which the wetting is complete in planar geometry, Laplace pressure suppresses divergence of the mean thickness of the wetting layer $l_W$, leading to a power law $l_W \propto r_0^{1/3}$. At a critical wetting transition of a planar substrate, curvature adds a relevant field; the corresponding multiscaling forms are readily available. The method allows for the systematic evaluation of corrections to the leading behavior; the next to the leading term reduces the thickness by the amount proportional to $r_0^{-1/3}$.