

## Long-range effects in the Fick-Jacobs equation for diffusion in narrow channels

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In some situations such as hoarded media where there are high concentrations or when there are memory effects, the diffusive flux is not enough to describe the behavior of the system, so it is necessary to consider long-range terms. This can be achieved by introducing a biharmonic additional term in the Fick equation [1]. In this work, we study the effect of a biharmonic term on the diffusion of Brownian particles confined in a 2D narrow channel whose longitudinal coordinate is larger than the transverse coordinate [2]. A Fick-Jacobs type equation is found using the projection method [3], with a third-order entropic flux additional to the standard first-order flux, where, even at the lowest order, position-dependent modifications appear in the longitudinal diffusivity and in the drift term, involving an additional scale. Furthermore, higher order corrections to the corresponding diffusion and long-range coefficients, both dependent on the longitudinal coordinate, are obtained iteratively.

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