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Two-Scale Simulations of Epitaxial Surfaces

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Spiral surface growth is well understood in the limit where motion of the spiral ridge is controlled by the local supersaturation of adatoms in its surrounding. In liquid epitaxial growth, however, spirals can form governed by both, transport of heat as well as solute. Here we propose a new two-scale model of epitaxial growth which takes into account all of these transport processes. Our model assumes a separation of time scales for the transport of heat compared to that of the solutal field. It allows for the first time for numerical simulations of extended surfaces regions by at the same time taking into account micro-structure evolution and micro-structure interaction. We apply this model successfully to extend the scaling relation for the step spacing given by the BCF theory to micro-structure evolution governed by heat and solutal transport. Applications of the model are illustrated by simulations.

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