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Elliptic Phases: A Study of the Nonlinear Elasticity of Twist- CHRISTIAN SANTANGELO, RANDALL KAMIEN, University of Pennsylvania — The twist-grain boundary phase in smectic-A liquid crystals, constructed from rotating walls of parallel screw dislocations, is a prime example of a stable, ordered configuration of defects. In smectics, nonlinearities in the strains strongly affect the energetics and interactions between defects, thus complicating their analysis. By exploiting the properties of Jacobi elliptic functions, we construct a triply-periodic surface locally composed of screw dislocations, called Schnerk's surface, which has the structure of a series of ninety degree twist-grain boundaries. This is a candidate structure for the recently observed large-angle twist-grain boundary phases. Because of the analytic tractability of our construction, we compute that the grain boundaries interact exponentially at long distances through both the compression and bending energies, and that there is a preferred grain boundary spacing.

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