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Pearling of drops sliding down a plane in partial wetting conditions. LAURENT LIMAT, Laboratoire MSC, Universite Paris Diderot, JACCO SNOEIJER, Dept of Mathematics, University of Bristol, NOLWENN LE GRAND-PITEIRA, Laboratoire MSC, Universite Paris Diderot, HOWARD STONE, Dept. of Chemical Engineering, Harvard University, JENS EGGERS, Dept. of Mathematics, University of Bristol — A drop sliding down a plane exhibits surprising shape changes when its velocity is increased. Oval at low velocity, it develops a "corner" when the drop velocity exceeds a critical value. The rear front adopts a conical shape, i.e develops a point singularity at the receding contact line. At even higher velocities, the corner evolves towards a cusp and later a tail that breaks into smaller droplets. We propose a simple model of this "pearling" transition in the limit of slender drops, for which the lateral scale is much smaller than the longitudinal one. We show that for a given capillary number, there are two different possible cone angle values, one stable, the other unstable. Above a critical capillary number, this model predicts the disappearance of these two solutions, the critical value of the half opening angle of the corner being of order 24 degrees. In this new regime, solutions involving a long rivulet left behind the drop appear, that can ultimately breaks into droplets. These calculations are in good agreement with experiments performed on silicon oil drops sliding down a plane coated with fluoropolymers.

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