Capillary Emptying and Wetting Transitions: Why the Tragedy of Spilling a Glass of Beer is Actually a Rare Interfacial Phase Transition

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ABSTRACT:

Imagine a glass half full of delicious beer. What happens when we turn the glass slowly to the horizontal? – of course our nutritious breakfast spills. And yet later that morning a cocktail straw half full of pina colada does not spill when we hold that horizontally. Amazingly this basic aspect of capillarity, equivalent to understanding the shape of a meniscus in a horizontal capillary, has not been studied in depth. Here we show that the process by which a liquid spills from a tilted capillary is a macroscopic example of a phase transition involving the unbinding of the meniscus. The critical singularities describing this are identical to those for short ranged wetting transitions but occur on a scale set by the capillary length rather than the bulk correlation length.
[1] A.O. Parry, C. Rascon, E. Jamie, and D. Aarts, Phys. Rev. Lett. 108, 246101 (2012).