Stability of the Taylor–Culick receding rim: surprising observations HENRI LHUISSIER, IRPHE, EMMANUEL VILLERMAUX, Universite de Provence — When punctured, a uniform liquid sheet is known, since Taylor and Culick, to recess at a constant speed balancing surface tension and inertia. For planar soap films, this steady solution holds until the initially smooth receding rim is violently destabilized, exhibiting deep indentations from which droplets are ejected. A surprising new three dimensional mechanism explaining this destabilization and resulting wavelength has been evidenced : because of the shear between the still outer medium and the receding liquid, the film flaps through a Kelvin–Helmholtz instability, itself inducing an acceleration perpendicular to the film, which intensifies with the flapping amplitude. To this acceleration is associated a classical Rayleigh–Taylor mechanism, promoting the rim indentations. The same mechanism holds for a punctured round bubble, for which the relevant acceleration is the Culick velocity squared divided by the bubble radius. The bearing of this phenomenon on aerosols formation in Nature will be underlined.

Emmanuel Villermaux
Universite de Provence