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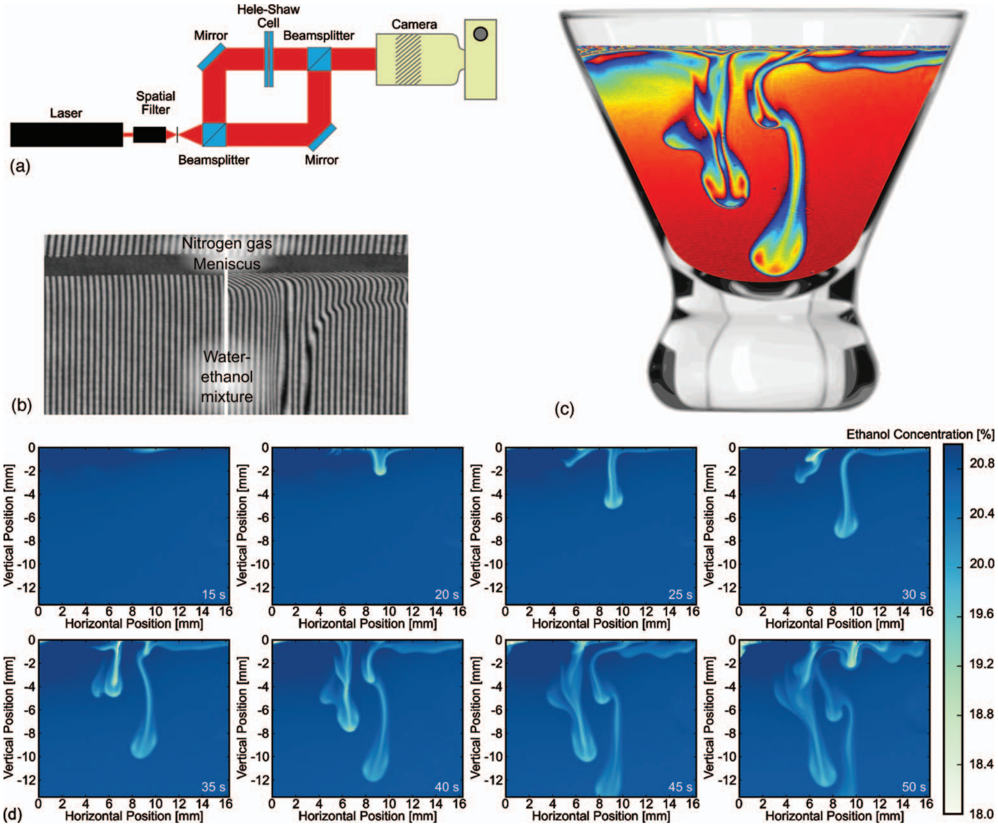


FIG. 1. (Color) (a) Sketch of the Mach–Zehnder interferometer setup used in this study. (b) Example raw images showing the nonevaporating reference state (left), together with an evaporating state (right) showing phase shifts generated by refractive index changes in the liquid. (c) Artistic combination of an experimental phase shift image and a cocktail glass. (d) Ethanol concentration map at different moments after starting the evaporation (enhanced online). [URL: http://dx.doi.org/10.1063/1.3205483.1]

# Evaporating cocktails

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Evaporation of an aqueous solution with 20.8% ethanol is studied at room temperature and atmospheric pressure, in a Hele-Shaw cell. The latter is composed of two glass plates maintained 1 mm apart, and in between which the studied mixture is filled up to some height. Evaporation is maintained by flowing dry nitrogen at some distance from the evaporating interface. The Hele-Shaw cell is placed in one of the arms of a Mach–Zehnder interferometer [see Fig. 1(a)], and the resulting fringe patterns [Fig. 1(b)] are recorded by a charge-coupled device camera.

Using a suitable demodulation technique based on the Fourier transform method,[1] it is possible to compute the refractive index field (averaged across the cell gap width) for each fringe pattern, and to subtract the reference (nonevaporating) refractive index field. This allows to detect variations due to evaporation-driven concentration and temperature differences, even though the latter contribution can be shown to be reasonably small.

Due to preferential evaporation of ethanol, a boundary layer starts to grow from the interface as soon as the nitrogen flow is initiated. As ethanol is lighter than water, this water-rich boundary layer is heavier than the liquid bulk, resulting in an unstable situation which quickly leads to Rayleigh–Taylor-like plumes of denser liquid plunging into the quiescent bulk. The dynamics turns out to be quite complex, especially when the stagnant gas layer above the interface is thinner or the temperature higher, i.e., the evaporation rate is larger.

Currently, the setup is optimized in order to fully control all parameters affecting this delicate evaporation process, and to reach agreement with a theoretical model under development by some of the authors.

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