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## A polarization-induced Rayleigh instability: Ferroelectric liquid droplets exploding on ferroelectric solid surface

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We present a study on the electrostatic behavior of ferroelectric liquid droplets exposed to the pyroelectric field of a lithium niobate ferroelectric crystal substrate. The ferroelectric liquid is a nematic liquid crystal in which almost complete polar ordering of the molecular dipoles generates an internal macroscopic polarization locally collinear to the mean molecular long axis. Upon entering the ferroelectric phase by reducing the temperature from the nematic phase, the liquid crystal droplets become electromechanically unstable and disintegrate by the explosive emission of fluid jets. These jets are mostly interfacial, spreading out on the substrate surface, and exhibit fractal branching out into smaller streams to eventually disrupt, forming secondary droplets. We understand this behavior as a manifestation of the Rayleigh instability of electrically charged fluid droplets, expected when the electrostatic repulsion exceeds the surface tension of the fluid. In this case, the charges are due to the bulk polarization of the ferroelectric fluid which couples to the pyroelectric polarization of the underlying lithium niobate substrate through its fringing field and solid-fluid interface coupling. Since the ejection of fluid does not neutralize the droplet surfaces, they can undergo multiple explosive events as the temperature decreases.

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