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Visco-capillarity in Sparkling Fireworks CHIHIRO INOUE, The University of Tokyo, EMMANUEL VILLERMAUX, IRPHE, UTOKYO TEAM, IRPHE TEAM — A unique toy firework called sparkling fireworks is popular in Japan for 400 years, but the physics behind the beauty remains a hidden mystery. Sparkling fireworks are made by a twisted paper simply wrapping 0.1g of black powder at the lower end. Ignited there, the powder melts in a fireball of molten salts, and streaks of light are ejected. The beautiful fragile streaks are visible from the black body radiation of the hot surface of the ejected droplets. The droplets suddenly fragment up to ten times successively and their light streaks traces are like pine needles. We have already clarified why the droplets are ejected through the bursting of a gas bubble on the mother fireball, leading to successive fragmentations by micro explosions. To quantify phenomenon, we measure the diameter and the ejection velocity of the droplets. It is found that not only inertia and capillarity of the liquid matter, but also its viscosity is important (the Ohnesorge number is about 0.1). The droplets ejection velocity is determined by the liquid surface tension and viscosity, and separate from the mother drop on a visco-capillarity time scale.

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