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Tunable Chemical Plumes MICHAEL ROGERS, STEPHEN MORRIS, Department of Physics, University of Toronto — Buoyant plumes are typically studied in the laboratory by injecting fluid into a denser medium. Plumes produced in this way entrain less buoyant fluid from their surroundings, dampening the buoyancy of the ascending fluid. Here, we consider a new type of plume that is produced by an autocatalytic chemical reaction - the iodate-arsenous acid reaction. The reaction occurs at a sharp front which separates reactants from less dense products. Using this reaction, buoyancy-driven chemical plumes are created by allowing an ascending front to escape from a capillary tube into a large tank. In a plume created in this way, entrainment assists the reaction, producing new buoyancy by delivering reactant into the plume. The behavior of chemical plumes is 'tuned' by altering both the viscosity of the system, and the ratio of chemical reactants. Chemical plumes may be tuned in such a way that overturning vortical flow is produced in the plume head. Such vortical motion stirs in fresh reactant solution and can drive the detachment of the plume head, which subsequently forms a free, accelerating vortex ring. Depending on the viscosity and concentration of the reactant solution, successive detachments may form multiple generations of chemical plume heads from a single initiation event.

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