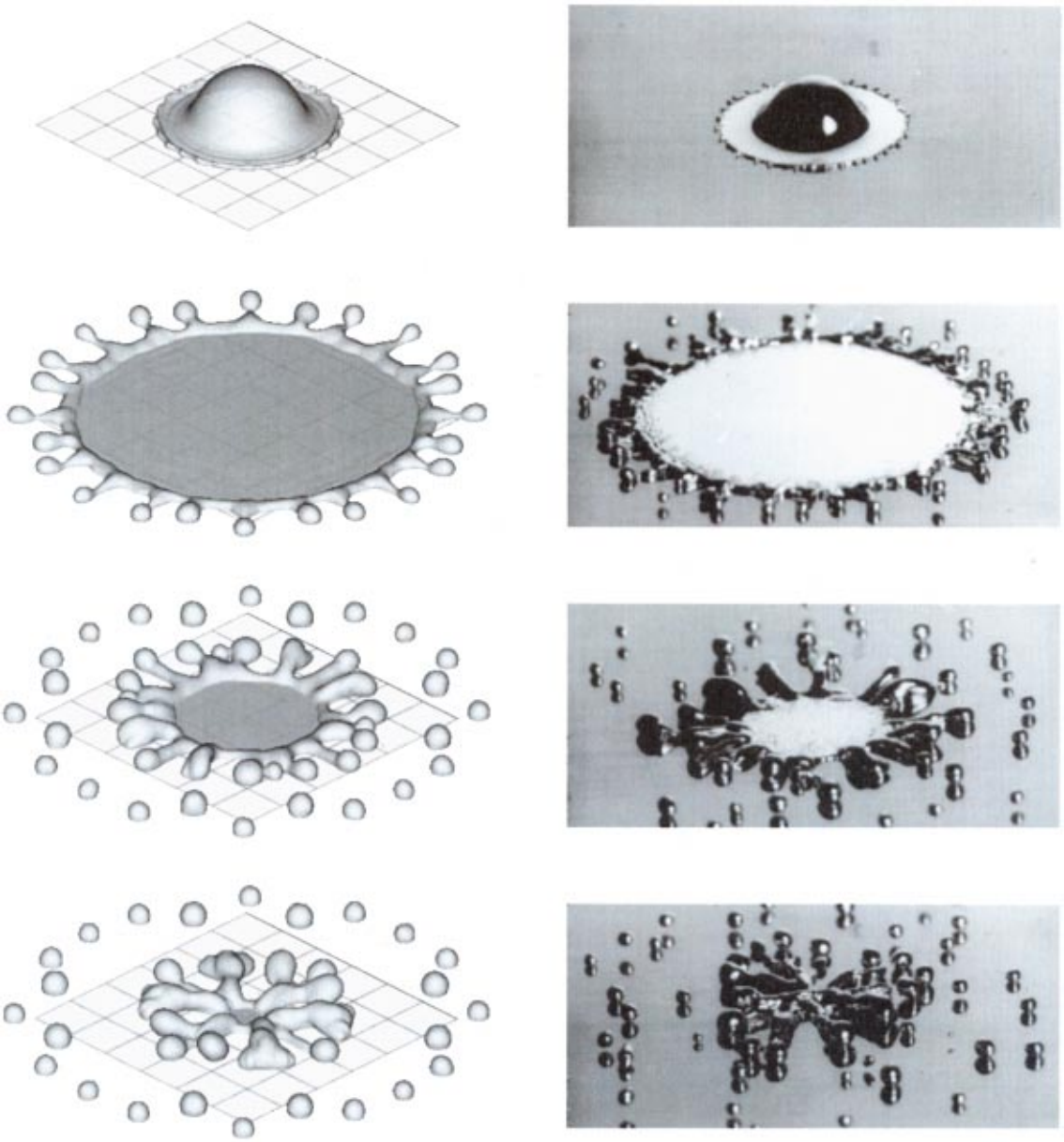

PHOTOGRAPHS AND SIMULATIONS OF MOLTEN METAL DROPLETS LANDING ON A SOLID SURFACE

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We present photographs and numerical simulations of the impact of molten tin droplets onto a solid stainless steel surface. A single-shot flash photographic technique is used to capture droplet impact. An electronic flash unit takes a single 35-mm photograph of a droplet at one instant after impact. As a droplet falls towards the surface it interrupts the beam of a 0.5 mW He-Ne laser. A photodiode detects this interruption and signals the time delay circuit, which opens the shutter of a 35-mm camera and then after a preset delay triggers the flash unit, producing an 8-μs duration flash. Impacting droplets are photographed at different stages of deformation by varying the time delay before triggering the flash, and the entire impact process pieced together from these photographs.

To simulate droplet impact we have developed a three-dimensional free surface flow model. The model combines a fixed-grid finite volume discretization of the Navier-Stokes equations with a volume tracking method to track the free surface location. The model is capable of predicting complex fluid deformation during droplet impact, including spreading and recoil. We simulate the growth of instabilities around the rim of an impacting droplet, which leads to splashing and the detachment of satellite droplets.

