



Sweep Photograph of a Decelerating Projectile

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This photograph shows 12 successive images of the path of a BB shot downward into a 40 cm deep tank of water. The images were produced as 12 electronic flash units were discharged at time intervals of 0.30 milliseconds. The separation of the images was achieved by using a rotating mirror to sweep the images across a single frame of film. The result is a displacement versus time record of the projectile's motion.

A computer was used to synchronize the arrival of the BB at the water's surface with the rotation of the mirror into the optimum position to reflect the images onto the film. A predetermined time before the mirror was in this position, a flag on the mirror broke a photogate, signaling the computer to actuate a solenoid which pulled the trigger of the BB gun. As the BB reached the surface of the water, the mirror reached the optimum position and the computer initiated the flash discharge sequence.

The speed of the BB at the water's surface was 233 m/s, as measured using infrared photogates. The speed then decreased rapidly due to the upward drag force of the water. The BB's displacement below the water's surface showed a logarithmic dependence on the elapsed time, a result consistent with established theory.