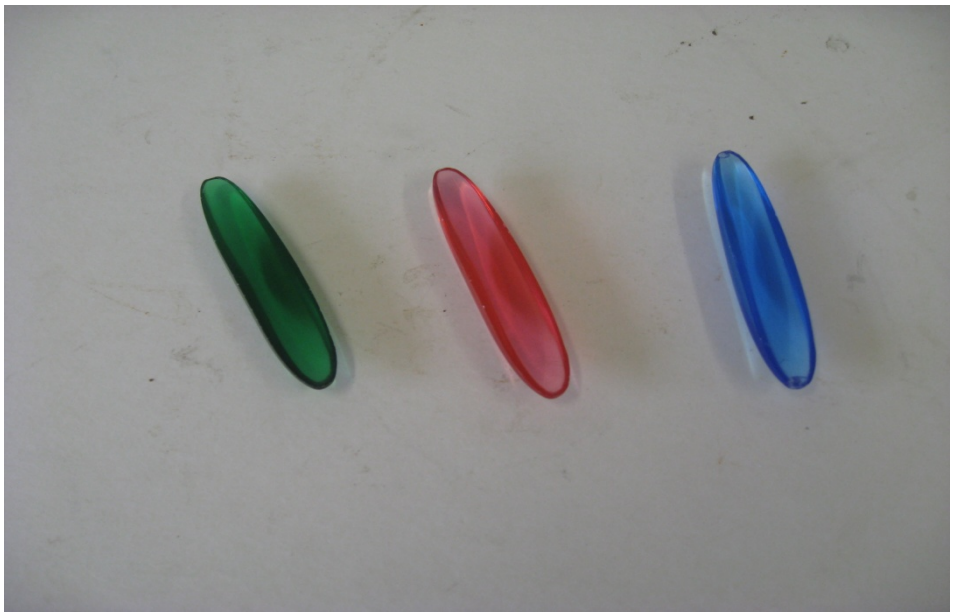
MM-5

Rotation
The Rattleback
Overhead Projector
M-4 S-2



It has been observed for many years that certain stones exhibit an interesting property when spun on a flat smooth surface. This was apparently first noticed by archaeologists in the ground granite axes known as celts. These stones showed a preference in their direction of spin, and if spun in the opposite direction they would stop and reverse themselves.

These rattlebacks, as they are known, have been reproduced in plastic for the toy market. They can be placed on a table or desktop or on the stage of an overhead projector or document camera for demonstration. If spun clockwise, they complete a revolution or two, stop, rock about their short horizontal axis, and spin counterclockwise. If rocked, they quickly stop rocking and begin to spin counterclockwise.

The explanation for this behavior seems to lie in the shape of the lower surface of the rattleback and in the distribution of mass. When spun clockwise, oscillating motions take place about both horizontal axes which appear to have a phase relationship which produces a net counterclockwise torque. The factor that determines that rattleback's preferred direction is the angle between the major axis of the ellipsoid and its "keel." The preferred direction is toward the major axis and away from the "keel."

An article from the "Amateur Scientist" column of the Scientific American is available with the rattleback.