The apparent path of Halley's Comet

David Chandler
Webb School of California, 1175 W. Baseline Road, Claremont, CA 91711

Fig. 1. The paths of Halley's Comet as seen from the earth (crosses) and from the sun (boxes) are shown from its recovery in 1982 into November 1985. Note that the geocentric path is an oscillation around the heliocentric path with the oscillations growing larger as the comet approaches the inner solar system.

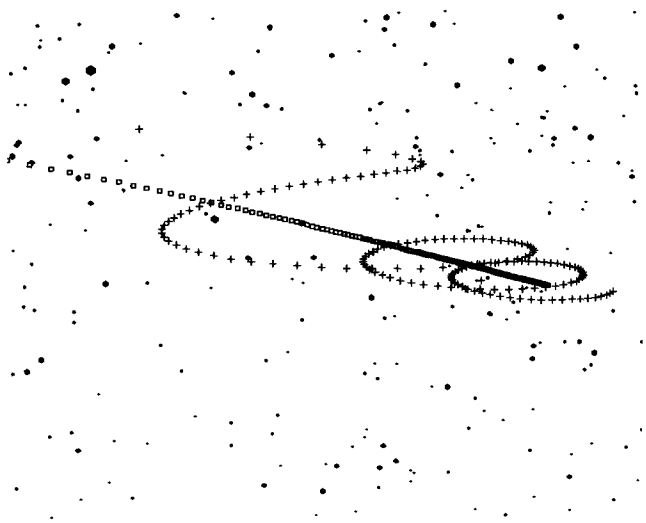

Fig. 2. The paths of the earth (crosses) and of the sun (boxes) are shown as they would appear viewed from Halley's Comet. The earth can be visualized orbiting the sun. The sun and earth drift slowly across the sky, and the earth's orbit grows as the comet we are riding drifts into the inner solar system. Note that the path of the earth, as seen from the comet, is a simple mirror image of the path of the comet as seen from the earth, projected on the opposite part of the sky. The constellation Scorpius is in the lower right-hand corner and Sagittarius in the lower left.

When the path of Halley's comet (as seen from the earth) is traced on a star chart, the result is a looping motion in the years preceding 1985, a mad dash across the sky in 1985 and 1986, and a return to the looping motion in the years that follow. Making sense of the complicated path, in terms of the simple ellipse the comet follows in space, is an interesting conceptual exercise.

Figure 1 shows the path of the comet, from the time of its recovery in 1982 through November 1985, as it starts its big sweep across the sky. The path, as seen from the earth (indicated by crosses) is shown together with the path as it would be seen from the sun (indicated by boxes). Moving from the geocentric to the heliocentric perspective immediately simplifies the picture. As seen from the sun, the comet slowly drifts among the background stars in a simple arc, picking up speed and circling the sky as it falls inward through the solar system. On a sphere, the heliocentric path would lie on a great circle. The path, as viewed from the earth, would oscillate about the path as seen from the sun. The oscillations grow larger as the comet approaches.

A simple change of perspective may shed a new light on the nature of the motion. Figure 2 shows the earth and sun as seen from Halley's Comet. What we see is the earth orbiting the sun from the slowly drifting vantage point of the comet. Note that the path is a mirror image of the path of the comet in Fig. 1 projected on the opposite side of the sky. As the comet approaches the sun, the earth's orbit grows, and the motions of the earth and sun across the sky become faster.

If two observers, A and B, each observe the relative motions of the other, the line of sight from A to B and the line of sight from B to A, lie along the same line but in opposite directions. The pattern A traces out against the distant background from B's perspective, and the pattern B traces out against the distant background from A's perspective are simple mirror images of each other. The transformation can be illustrated by pivoting a stick at its center while sighting along it first one way, then the other. Whatever pattern is traced out by one end of the stick, is traced out in a mirror image by the other end.

Visualizing the motions of the sun and earth from a slowly drifting platform in space, may be a simpler conceptual task than trying to visualize a slowly drifting object from the point of view of a rapidly oscillating platform. Once the motion of the earth as seen from the comet can be visualized, and the implications of reversing the line of sight are understood, the complex nature of the comet path as seen from the earth becomes clear.