Iowa Science Teachers Journal

Volume 27 | Number 3 Article 8

1990

Astronomy Resources

Thomas Hockey
University of Northern Iowa

Figure 4: This is the sky seen by a person facing west on May 20 at about 11 p.m. The six constellations shown are Leo, Cnc=Cancer, Lyn=Lynx, CMi=Canis Minor, Aug=Auriga and Gem=Gemini. On this night, there is another interesting alignment formed by the Moon and three planets. The Moon is in the first quarter phase and is illuminated 54 percent. *Jupiter* remains in Cancer. *Mars* is 11° to the lower-right of Jupiter. *Venus* is the bright object 14° to the lower right of Mars. Venus may be difficult to see as it is only about 10° above the horizon at this time.

P. Steven Leiker
Project ESTEEM
Center for Astrophysics
60 Garden Street, MS 71
Cambridge, MA 02138

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Here are two brief demonstrations that I find useful in teaching planetary astronomy. The latter was inspired by a segment on the *Nova* series of public television programs, which is always a sources of ideas for visually presenting science.

Until the twentieth century, very few physical properties of the other planets in our Solar System were observable from the Earth. One of them was rotation rate. A spinning billiard ball very nicely represents a turning solid planet.

I ask introductory astronomy students to determine the length of the day for a "pool-table planet." Very quickly, they realize that by counting during a known interval of time, the appearances (or disappearances) of a feature on the billiard ball "planet" (in this case the number on the ball) they can determine the rotation period (Figure 1).

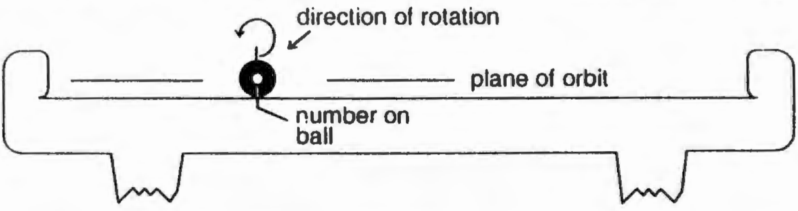

Figure 1

As a second exercise, the problem of finding the length of the day on Venus is presented. The white cue ball credibly represents the white, featureless disk of that planet. When the cue ball is spun, the students are unable to determine a frequency of rotation as they have no reference feature. The rotation rate becomes much more difficult to estimate. I then discuss radar as a means of "seeing" features on an otherwise cloud-enshrouded surface of Venus. I attach a small sticker to the ball and spin it at the same basic rate as before. Now, the rotation period is easily determined.

The marked billiard ball can also be used as a handy reference sphere for discussions of planetary obliquity (the "tilt" of the rotation axis with respect to the plane of the planet's orbit about the Sun). Rolling the ball so that the sticker marks the axis of rotation can simulate the polar view the Voyager spacecraft obtained of cloud features on Uranus. As the planet has an obliquity such that its rotation axis is nearly in its orbital plane, its "poles" are actually on what we have come to think of as the "sides" of most planets rather than the "top" and "bottom" (Figures 2 and 3).

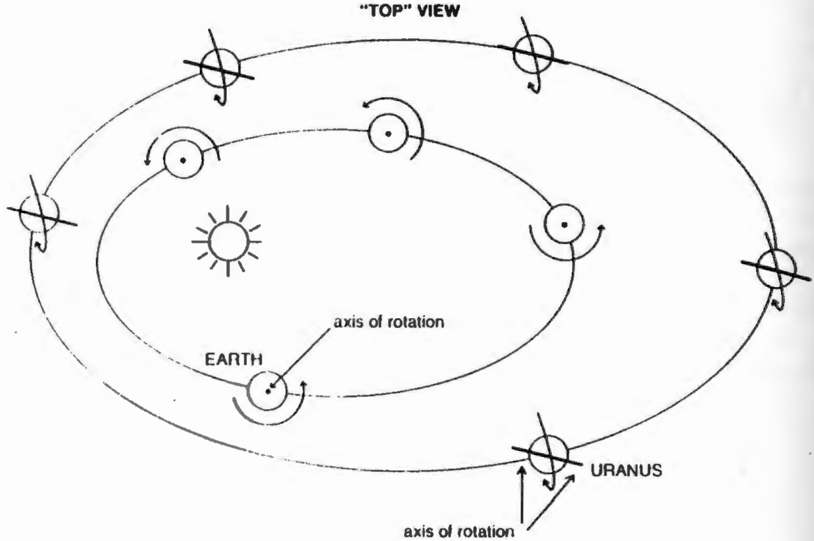

Figure 2

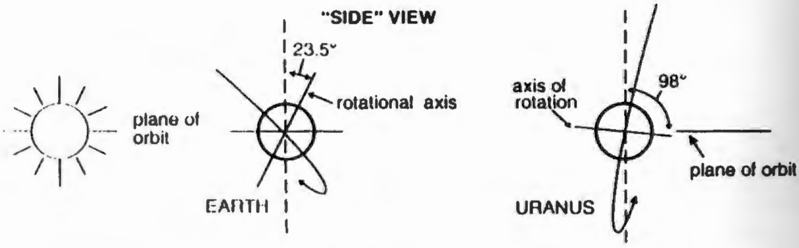

Figure 3

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A principal constituent of the Galilean satellite Io is sulfur. Sulfur is responsible for the unique geologic activity observable on that world, yet I often find that introductory astronomy students have little experience with this element.

As an exercise in observational planetology, I let students examine a Voyager spacecraft image of the disk of Io. Such pictures show the colorful appearance of Io, the surface of which is "painted" in rich yellows, oranges, reds, browns, blacks and whites. I then heat some laboratory sulfur in a test tube over a bunsen burner. As it warms, the sulfur turns from yellow to orange, red, brown, and then, finally, black before vaporizing. I ask the students to interpret the colors of Io in terms of the temperatures to which various portions of the surface have been exposed (why, for instance, is a volcano on Io black and a lava flow emanating from it red?). I add that sulfur in the classroom is already "warm" in the sense that, in the extreme cold that exists in the outer Solar System, this element is white.

NOTE: In the above demonstration using vaporized sulfur, care should be taken so as not to expose students who are more than normally sensitive to chemical odors.

Dr. Thomas Hockey
Department of Earth Science
University of Northern Iowa
Cedar Falls, IA 50614-0506