THE ANALEMMA PROJECT

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Abstract: By marking the sub-solar point on a fixed globe through 12 months, you can trace out the Sun's figure-eight-shaped analemma—a cheap, easy, long-term observation project. See http://analyzer.depaul.edu/paperplate/analemma.htm **for details and images.**

Analemmas are disappearing from globes as modern manufacturers often fail to include the curious figure-eight shape that indicates the equation of time. *The Analemma Project* plots the Sun's path at noon directly onto a globe, eventually revealing the midday Sun's curving migration between the tropics. With simple materials and patience, you can create an analemma from personal observation.

For starters, make a Sub-solar Cup as described and shown at http://analyzer.depaul.edu/paperplate/analemma.htm. Basically, you drill a hole in the bottom of the cup, put cross-hairs of thread across the opening on top of the cup, and cut a viewing window into the side of the cup.

Next, secure the globe on a base so that your geographic location is positioned on the uppermost part of the globe. If you place a small toy doll on your site, it should stand upright on the globe. Align the globe with your longitude running north and south. Essentially, the globe parallels the position of the Earth relative to the true sky, only shrunk down. The axis of the globe points to the north celestial pole.

If you can permanently affix your globe to your observation site for 12 months, your results will improve dramatically. In the trial run, I had to reset the base for each observation because the only spot at home that sees Sun at noon year-round is in the driveway. Results were compromised because the base was not consistently aligned.

When the bright circular Sun is centered on the crosshairs, mark the sub-solar point (where someone would see the Sun directly overhead at that moment). Repeat the process at noon regularly throughout the year. After 12 months, you should have a figure-eight shape plotted on your globe.

Notes:

° The Sun's actual noon path on the globe is a mirror image of the analemma printed on the globe, for the globe version shows the correction that must be applied. On the printed analemma, the beginning of the new year starts low near the Tropic of Capricorn and bends left, or westward. However, the Sun's true path that you plot shows the slowing Sun creeping toward the east at the beginning of the year.

° The time at which you make the observation has to be consistent. Pick a time of day that will be convenient on a regular basis. Noon is nice when the project is over, but, for me, a few hours later—when I had to be home in the driveway to greet the school bus—would have been more practical.

° If you are late or early by only a few minutes in plotting the sub-solar point, your results will be affected. Often an anticipated observation will be thwarted by an errant, slow moving cloud.

° When choosing your observing hour, don't forget to account for Daylight Saving Time. I had the (rare) benefit of always being on Eastern Standard Time in Indiana.

° From our site at 86 degrees of west longitude, the Sun's path, defined by the figure-eight, is to the west at noon all year. In fact, it clearly straddles the 75 degree meridian—an opportunity to address time zones.

° The demise of the analemma is illustrated by (or hints at the shortcomings of) Microsoft's spell-checker feature. Be prepared for the snickers from Microsoft's recommendations for "analemma."

° In recent years, *Sky & Telescope* senior editor Dennis Di Cicco has inspired photographers to capture year-long exposures of the noon Sun to illustrate the Sun's changing position through the seasons—a daunting but attainable challenge. Those images are a nice companion to this activity. The Analemma Project has a different approach with a parallel outcome. Patience is rewarded with a clear, graphic feature.

° Thanks go to Gary Tomlinson, who suggested to me the Sub-Solar Cup activity on which the Analemma Project is based. He contributed the original reference to an activity written by Robert Mitchell. See *The Physics Teacher*, May 1991, pp. 318-319.