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Question 1: Snow Volume; Question 2: Longbow Arrow Velocity

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some of the oldest IR data have such obvious pixels? If you find a target that moves, like Barnard's Star, you can watch it move from the 1950s through 2010, and calculate its proper motion.

When you are ready to include catalogs, you can use Finder Chart to retrieve the catalogs and make plots of the source characteristics it retrieves, or you can initiate a new search in other catalogs held at IRSA (or found elsewhere on the web). It overlays the catalog on the image and makes a plot—you can change what is plotted and do simple mathematical manipulations of the columns to plot. The catalog, plot, and images are all interlinked, such that if you click on a source in the plot, it is highlighted in the image and catalog too. One of the IRSA video tutorials[8] demonstrates in ~three minutes how to take the Gliese-Jahreiss list of nearby stars,[9] retrieve a Gaia[10] catalog for those stars, and make a color-magnitude diagram, correcting the magnitudes individually for distance. It will look very much like HR diagrams in textbooks! You can then click on sources in the plot to identify specific nearby white dwarfs and giants in the catalog.

We do not—yet—have "cookbook labs" for these tools. We are developing some as part of NITARP, the NASA/IPAC Teacher Archive Research Program. What we have is collected on the web.[11] We hope to add more labs in the future, but in the meantime, a whole universe is available for anyone to explore!

References

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Fermi Questions

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Question 1: Snow volume

How much snow falls on the U.S. each winter?

Question 2: Longbow arrow velocity

Arrows from English longbows could penetrate plate armor. What is the velocity of an arrow shot from an English longbow?

Look for the answers online at tpt.aapt.org under "Browse," at the very end of the current issue.

Question suggestions are always welcome!

For more Fermi questions and answers, see *Guesstimation 2.0: Solving Today's Problems on the Back of a Napkin,* by Lawrence Weinstein (Princeton University Press, 2012).

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