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Question 1: Coffee Consumption; Question 2: Active Volcanoes

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activity's focus on an understanding of cosmology adds to an area of education that is often missing in the average science classroom,^{9,10} supplementing other works focused on replicating astronomical experiments, like determining the Hubble constant.^{11,12} Additionally, once students have completed the activity, they have performed a part of a Nobel Prize-winning analysis, showing them that they can participate in important science, whatever their educational background.

By including this and other similar activities throughout an introductory astronomy course, the non-science major students are able to develop an in-depth understanding of how science research is performed without being overwhelmed by difficult math concepts. In the example of measuring universal expansion described in this paper, the students rely on knowledge they had already developed on redshifts and supernovae to determine which theoretical model for the future of the universe best fits the data they are given. They then analyze and discuss the significance of their results, which gives students an opportunity to consider how scientific knowledge evolves over time. The addition of activities during each class meeting provided a space for the students to learn to think as scientists in what could be the only science course they take during their undergraduate career. For more information and to see the full set of new activities, visit the author's webpage: www.physics.uwyo.edu/~jessicas.

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Fermi Questions

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► Question 1: Coffee consumption

How many bathtubs-full of coffee do U.S. physicists (or mathematicians) consume daily?

► Question 2: Active volcanoes

How many active volcanoes are there in the world?
(Thanks to Shaila Patricia Ramirez Vientós, Puerto Rico for asking this during my ODU REYES lecture.)

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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