Fourth-graders soak up the sky on night of astronomy

By Alan MacRobert
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STAR WATCH

Last Monday the Acton-Boxborough schools hosted their 13th annual astronomy night for fourth-graders and their families. As always, big crowds came out for inflatable-planetarium shows, a Galileo impersonator describing his discoveries, and impressive telescopes in the frigid night pointing at the moon and Jupiter, operated by hardy volunteers from the Amateur Telescope Makers of Boston.

I taught group after group of kids and parents how to use constellation charts to find their way around the night sky. Can you spot Orion, Gemini, Canis Major, the Big Dipper? Ten minutes and you'll know how to do it for the rest of your life.

A bright moon lit the sky with nature's own light pollution, so I stuck with bright Orion and its surroundings. The fourth-graders got it, moonlight and all. So did their parents. You can, too.

Start by looking south just after dusk in the next week or two. The brightest star there, not too high, is Sirius. You can't miss it.

Look to its upper right for the pattern of Orion, as shown here: a bent rectangle with a row of three stars in its middle, Orion's belt. Just remember that Orion will look bigger in the sky than on paper. The Belt points back toward Sirius, and the other way toward Aldebaran and then the Pleiades (off the chart).

Don't stress about the faint stars of Orion's club and shield; they'll await you some moonless night far from the city skyglow.

The kids asked some penetrating questions. I mentioned that Sirius was made of white-hot hydrogen. One asked, how do we know what Sirius is made of?

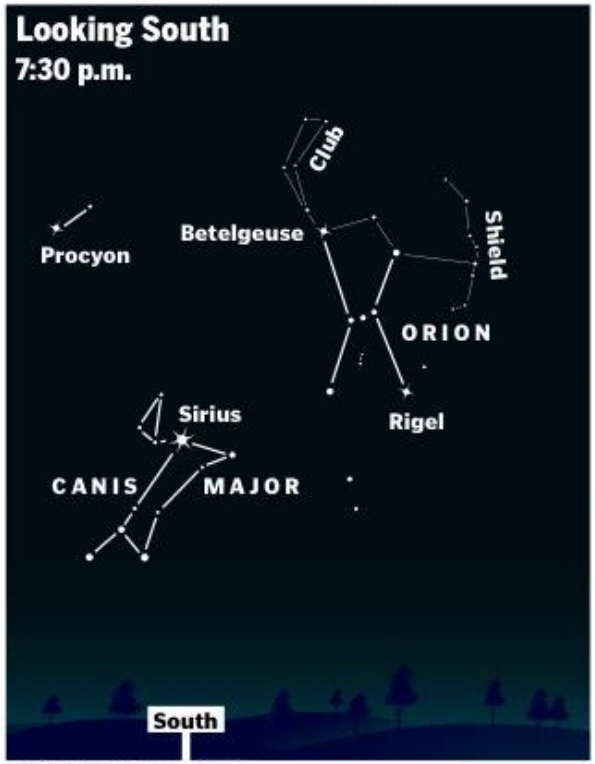
Good question. It's not like we can go there and fetch a sample. There are deep lessons here, but lessons a fourth-grader can grasp.

How do we know what we know?

People have always wondered what the sun and stars are made of. And as people everywhere do when they don't know something, they made up stories.

Everyone loves stories. We're built that way. And as always, many people confused their made-up stories with what's real.

The great philosophers of ancient Greece were awfully smart, but they too could fool themselves into believing their made-up stories. They decided that everything was a mix of four elements: earth, air, fire, and water. It was a good story "everyone knew."



SOURCE: Sky & Telescope Magazine GLOBE STAFF

But the heavenly bodies seemed so different that they ought to be made of something else. Aristotle named it quintessence, the "fifth essence."

And there things stood for a couple thousand years. By the 19th century, science — the art of examining things carefully — had replaced ancient philosophy for figuring out what things are made of. But the sun and stars were still out of reach.

And so it seemed they always would be. In 1835 the French philosopher-scientist Auguste Comte discussed whether anything can be absolutely beyond human knowledge forever. Yes, he said, and he cited the makeup of the stars and planets. "We can never know anything of their chemical or mineralogical structure."

But even before Comte wrote that, a German glass-polisher named Josef von Fraunhofer had become fascinated with using prisms to split sunlight into its individual colors. Examining the rainbow of sunlight ever more finely, he catalogued 475 thin, dark lines in the solar spectrum. Evidently, materials in the sun were absorbing light at these very precise wavelengths.

Two of the strongest lines exactly matched the spectral lines that Fraunhofer saw when he added sodium to a candle flame. There must be sodium in the sun.

The following years brought a great rush to identify more materials in the sun and stars. Each element, if present, left its own unique fingerprint of spectral lines. Astronomers identified more and more earthly substances making up the celestial realm.

The moral of the story: When learned authorities say a thing can never be known because they themselves can't see a way to investigate it at present, the next generation may show them up as fools.

In this regard, the physicists come to mind who recently thought their generation was onto the final "theory of everything." String theory looked to be it.

But instead, string theory turned out to have a fantastically huge number of solutions, all different, every one of which may correspond to a different kind of universe in an infinite "multiverse."

So much for wrapping up everything. Some physicists huff that the idea of a multiverse is pointless and pernicious, because we can't see any way ever to test it, at present. Such people, like Comte, assume that their generation of investigators is so special that they have the end of knowledge in sight and know what can never be investigated in the future.

But the history of science has always taught the foolishness of such self-centeredness, and the wisdom of humility.

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