Astronomers determine color of the Milky Way Galaxy

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Image credit: University of Pittsburgh

A team of astronomers in Pitt's Kenneth P. Dietrich School of Arts and Sciences announced today the most accurate determination yet of the color of the (aptly named) Milky Way Galaxy: "a very pure white, almost mirroring a fresh spring snowfall." Jeffrey Newman, Pitt professor of physics and astronomy, and Timothy Licquia, a PhD student in physics at Pitt, reported their findings during a presentation at the 219th American Astronomical Society (AAS) Meeting in Austin, Texas.

While color is one of the most important properties of galaxies that astronomers study, it has been difficult to make the measurement for the Milky Way, as our solar system is located well within the Galaxy. Because of this, clouds of gas and dust obscure all but the closest regions of the Galaxy from view, preventing researchers from getting the "big picture" (see http://home.arcor.de/AXEL.MELLINGER/ for a full-color

view of the Milky Way, where the obscuration is visible).

"The problem is similar to determining the overall color of the Earth, when you're only able to tell what Pennsylvania looks like," Newman noted.

To circumvent this problem, Newman and Licquia set out to determine the Milky Way's color by using images from other, more distant galaxies that can be viewed more clearly. These galaxies were observed by the Sloan Digital Sky Survey (SDSS), a project in which Pitt had an instrumental role that measured the detailed properties of nearly a million galaxies and has obtained color images of roughly a quarter of the sky. Without the large set of galaxies studied by SDSS to compare to, an accurate color determination was not possible. The new color measurement is allowing Pitt researchers to better understand the development of the Milky Way Galaxy and how it is related to other objects astronomers observe.

"The problem we faced was similar to determining the outside climate when you are in a room with no windows." said Newman. "You can't see what's happening, but you can look online and find current weather conditions someplace where they should be about the same—the local airport, for example."

The Pitt team identified galaxies similar to the Milky Way in properties that were able to be determined—specifically, their total amount of stars and the rate at which they are creating new stars, which are both related to the brightness and color of a galaxy. The Milky Way Galaxy, the Pitt researchers realized, should then fall somewhere within the range of colors of these matching objects.

"Thanks to SDSS, the large, uniform sample needed to select Milky Way analogs already existed. We just needed to think of the idea for the

project, and it was possible," said Newman. "Although it is a relatively small telescope, only 2.5 meters (100 inches) in diameter, SDSS has been one of the most scientifically productive in history, enabling thousands of new projects like this one."

Newman described the overall spectrum of light from the Milky Way as being very close to the light seen when looking at spring snow in the early morning, shortly after dawn. Michael Ramsey, Pitt associate professor of geology, notes that new spring snow is the whitest (natural) thing on Earth. Many cultures around the world have given the Milky Way names associated with milk—human vision is not sensitive to colors seen in faint light, so the diffuse glow of the Galaxy at night appears white. That association has proven to be very appropriate, given the Milky Way's true color.

Astronomers divide most galaxies into two broad categories based on their colors– relatively red galaxies that rarely form new stars and blue galaxies where stars are still being born. (The brightest stars are generally blue, but they are very short-lived on cosmic scales and die out quickly.) The new measurements place the Milky Way near the division between the two classes.

This adds to the evidence that although the Milky Way is still producing stars, it is "on it's way out," according to Newman. "A few billion years from now, our Galaxy will be a much more boring place, full of middle-aged stars slowly using up their fuel and dying off, but without any new ones to take their place. It will be less interesting for astronomers in other galaxies to look at, too: The Milky Way's spiral arms will fade into obscurity when there are no more blue stars left."

The Milky Way's color is exceedingly close to the "cosmic color" measured by Ivan Baldry, a professor of astrophysics at Liverpool John Moores University in England, and his collaborators in 2002; these

researchers measured the average color of galaxies in the local universe.

"This close match shows that in many ways the Milky Way is a pretty typical galaxy," said Newman. "This also agrees well with the 'Copernican Principle' embraced by the field of cosmology—that, just as the Earth is not in a special place in the solar system, we should not expect to live in an unusual place in the Universe."

The light from the Milky Way closely matches the light from a D48.4 standard illuminant, or a light bulb with a color temperature of 4700-5000K. "It is well within the range our eye can perceive as white—roughly halfway between the light from old-style incandescent light bulbs and the standard spectrum of white on a television," said Newman.

Provided by University of Pittsburgh