Nearby star cluster, long forgotten, now discovered to be useful in studies of Sun and search for planets like Earth

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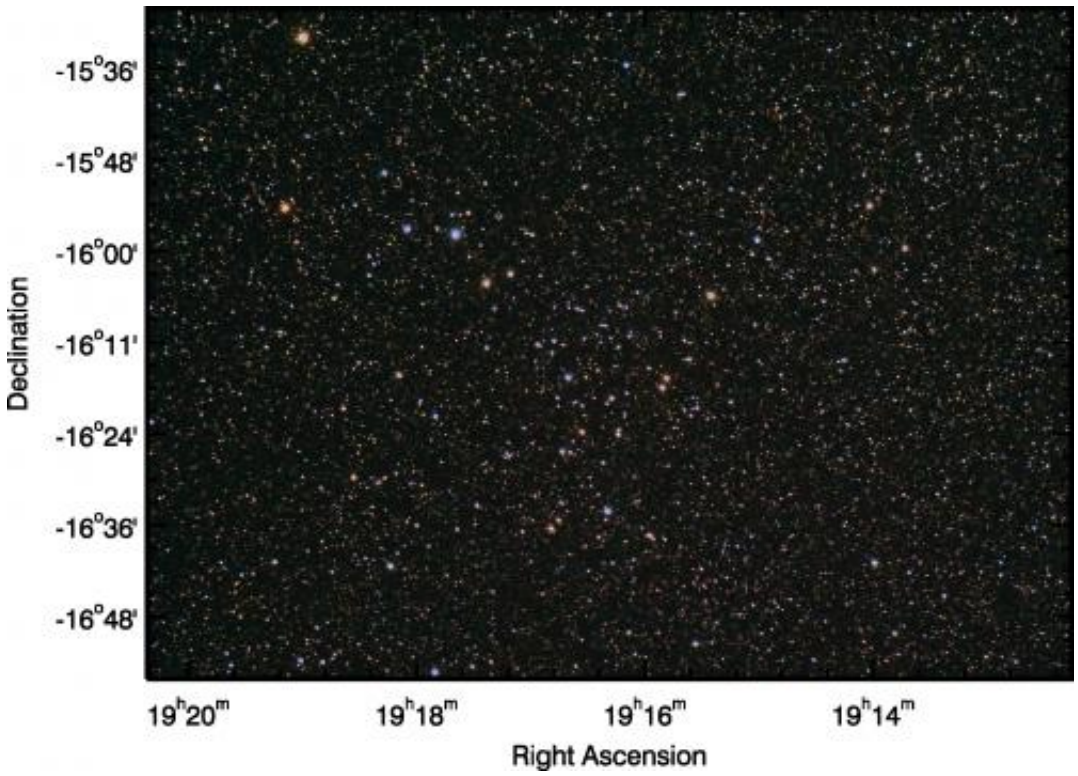


Penn State University astronomers have determined that 80 of the stars in this photo are members of the long-known but underappreciated star cluster Ruprecht 147. In this image, the brightest of these stars are circled in green, and the less-bright ones are circled in red. These stars were born out of the same cloud of gas and dust approximately two-billion years ago, and now are traveling together through space, bound by the force gravity. The astronomers have identified this cluster as a potentially important new reference gauge for fundamental stellar astrophysics. Credit: Image credit: Chris Beckett and Stefano Meneguolo, Royal Astronomical Society of Canada

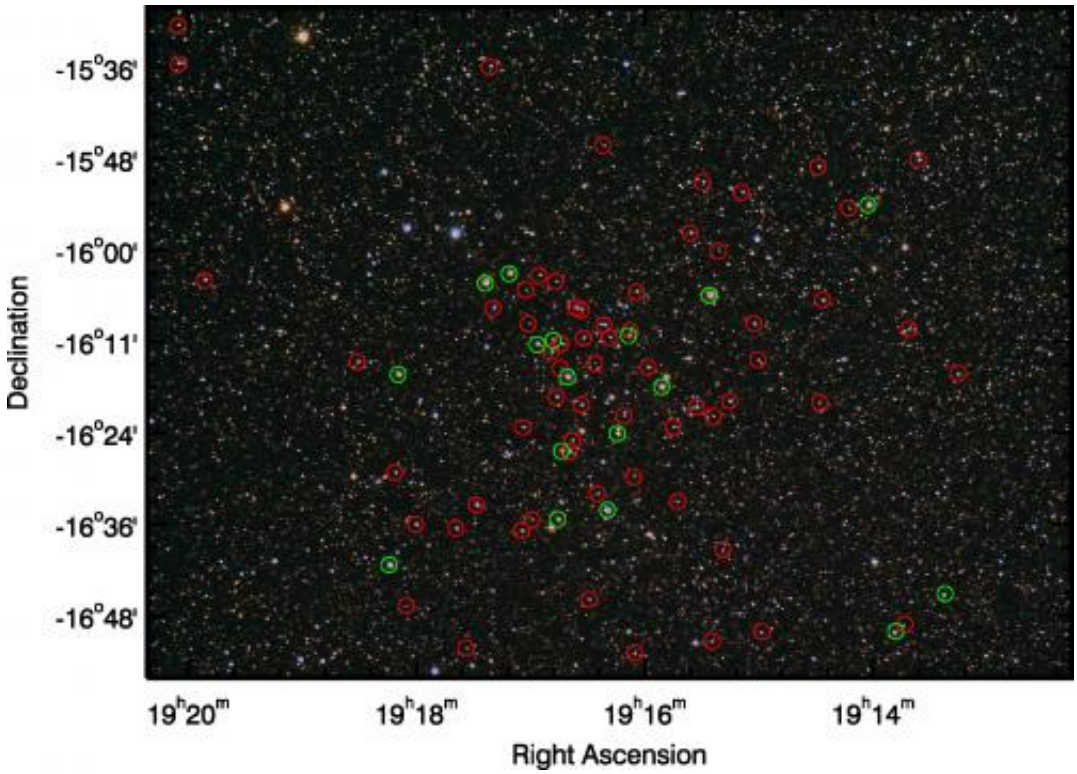
(Phys.org) -- A loose group of stars that was known for over 180 years but never before studied in detail has been revealed to be an important new tool in the quest to understand the evolution of stars like the Sun, and in the search for planets like Earth. "We have discovered that a previously unappreciated open star cluster, which is a little younger than our Sun, holds great promise for use as a standard gauge in fundamental stellar astrophysics," said Jason T. Wright, an assistant professor of astronomy and astrophysics at Penn State University, who conceived and initiated the research.

Wright's research team's first paper on the cluster, known as Ruprecht 147 or NGC 6774, has been submitted to the Astronomical Journal for publication. Team member Jason Curtis, a graduate student in Wright's lab, led the work for this paper and will present the team's project in Barcelona, Spain, later this month at the 17th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun.

When searching for planets with an Earth-like mass and an orbit that allows liquid water to exist on the surface, astronomers often search around stars the mass of the Sun and smaller. "The Ruprecht 147 cluster is very unusual and very important astrophysically because it is close to Earth and its stars are closer to the Sun's age than those in all the other nearby clusters," Wright said. "For the first time, we now have a useful laboratory in which to search for and study bright stars that are of similar mass and also of similar age as the Sun. When we discover planets around Sun-like and lower-mass stars, we will be able to interpret how old those stars are by comparing them to the stars in this cluster."

Wright's team has shown that Ruprecht 147 is 800 to 1,000 light years from Earth, which is so close that it is bright enough to be seen with binoculars in late-summertime skies in the constellation Sagittarius. "All

of the other nearby clusters astronomers study contain stars much younger than the Sun, and all of the older stars are more than 3,000 light years away. So this cluster, being both old and close, provides a unique opportunity," Wright said. Although it appears to be relatively large on the sky, the cluster can be difficult to spot because it is not very compact and it is located in the densest, brightest region between Earth and the center of the Milky Way galaxy.



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Curtis, Penn State University.

To study the Ruprecht 147 cluster, which is much larger on the sky than most objects astronomers study, the Wright's team had to use some specialized, wide-field cameras -- including those on the MMT telescope in Arizona and the Canada-France-Hawaii Telescope on Mauna Kea in Hawaii -- in order to get its many stars within the frame of view. "Even with these wide-field cameras, we've had to build mosaics of images to cover the whole cluster and to take very quick snapshots so that we don't overexpose the brightest stars, Wright said. "Most modern telescopes weren't designed for clusters so bright and close."

When the object was first discovered in 1830 by British astronomer John Herschel, he described it as "a very large straggling space full of loose stars." He subsequently included it in the General Catalog of astronomical objects, which he compiled based on the observations of his father William Herschel. "The cluster was rediscovered in the 1960s by Jaroslav Ruprecht, which is how it got its current name, but until now no astronomers paid it any special attention, probably because many presumed it was an asterism -- a chance alignment of unrelated stars," Wright said.

Wright's team's work has proven, for the first time, that the Ruprecht 147 cluster is only a bit younger than the Sun on the astronomical time scale. The stars in Ruprecht 147 are about 2.5-billion years old, or about half the age of the Sun, and about the age the Sun was when the first multicellular life emerged on Earth.

The team's initial observations also have measured the distance to Ruprecht 147, as well as the directions and velocities of its stars to verify that they are moving together through space in three dimensions, both

across the sky and in the same angle away from Earth. These observations confirm that these stars are members of a true cluster, not just a random pattern on the sky. Wright's team already has identified 100 stars as members of the cluster, and is working to find more.

Wright said that most of the work for this initial paper was done by Jason Curtis as part of his dissertation research. Curtis's work includes observations with the Canada France Hawaii Telescope (CFHT) and the Keck telescope in Hawaii, the Lick Observatory in California, and the MMT Observatory in Arizona.

"This project is exciting for me as a graduate student because it gives me the opportunity to use the latest astronomy techniques and instrumentation to explore a star cluster that has never before been investigated to this extent," Curtis said. "While this project has given me training in well-established, fundamental methods of astronomy observation and analysis, it is also opening up new doors to cutting-edge astrophysics research." For further studies, Curtis is participating in observations with the Magellan telescope in Chile and NASA's orbiting Chandra X-Ray Telescope.

In addition to Wright and Curtis, other co-authors of the team's first scientific paper include Angie Wolfgang, of the University of California, Santa Cruz; John Brewer, of Yale University; and John Asher Johnson of the California Institute of Technology. The US National Science Foundation provided financial support for this research.

"Our project with this important cluster is just beginning," Wright said "Eventually, it is going to let us find and study nearby stars with a mass like the Sun's, to help in the hunt for Earth-like planets, and to test and improve the models astronomers use to understand the evolution of stars including our own Sun."

More information: iopscience.iop.org/1538-3881/

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