



Michigan State University SOAR telescope gathering clues to how early elements formed

http://www.finefield.cn 2007-03-16

[作者] Michigan State University

[单位] Michigan State University

[摘要] March 15, 2007. EAST LANSING, Mich. — After nearly two years of tweaking and refining, Michigan State University's Southern Astrophysical Research, or SOAR, telescope, is looking to the stars and gathering data that are providing clues to how the light elements carbon and oxygen were originally formed.

[关键词] physics; astronomy; carbon; oxygen

March 15, 2007. EAST LANSING, Mich. —

After nearly two years of tweaking and refining, Michigan State University's Southern Astrophysical Research, or SOAR, telescope, is looking to the stars and gathering data that are providing clues to how the light elements carbon and oxygen were originally formed.

"For many years we've been developing techniques for finding very old stars," said Timothy Beers, MSU physics and astronomy professor. "Now we're starting to learn more about their nature and how they are related to the first generations of objects to have formed in the universe."

Located in the mountains of Chile, SOAR is a joint project between MSU, the University of North Carolina at Chapel Hill, the country of Brazil and the National Optical Astronomy Observatories. It officially went online in 2004.

The MSU research team, led by Beers, is using SOAR to detect the presence of elements, carbon and oxygen — considered the building blocks of life —

in a number of ancient stars and star systems, data that continue to yield more information on how these elements originated.

This latest research, the first to be published by MSU astronomers using the SOAR telescope, appears in the March issue of The Astronomical Journal.

"This study demonstrates the ability of SOAR to accurately measure the abundance of the element oxygen in stars with large amounts of carbon in their outer atmospheres," Beers said. "Studying these very old stars, some of which were among the first to be formed after the big bang, can reveal details of how some of the most important elements for life were formed." "At MSU we have a long history of studying the creation of elements in the laboratory, by using the accelerators in our National Superconducting Cyclotron Laboratory," said Wolfgang Bauer, chairperson of the department of physics and astronomy. "Now, with generous help from MSU and our many private donors, we also have in the SOAR telescope an instrument to study the same processes by looking back billions of years into the very early history of the universe."

When stars began to form some time after the big bang, the two main elements in the universe were hydrogen and helium. The first stars to form were thought to have been hundreds, if not thousands, of times more massive than the sun.

After extremely short lives, these stars exploded as supernovae and began to pollute the universe with heavier metals such as iron, carbon, nitrogen and oxygen. Consequently, older stars have very low levels of these substances.

Normally, measuring the levels of oxygen in stars that are considered "metal poor" requires long exposures with some of the world's largest telescopes. However, Beers and colleagues found a way to accurately measure the amount of oxygen in the stars using the smaller —

4.1 meter — SOAR telescope.

Among the stars that Beers and his team have been studying are binary stars, which are dual stars that orbit around one another. In these binaries, one of the two stars has essentially died and evolved into a smaller star known as a white dwarf.

Before dying, however, this member of the system evolved through a stage where large amounts of carbon, nitrogen, oxygen and other heavier elements were produced. This material was then transferred to the surface of the binary member star that is now observed.

"The 'fingerprint' of the measured abundances left on the surviving member provides clues to the process by which these elements were formed," he said. "Our technology is helping to preserve a laboratory that doesn't really exist today, and in fact has not been in operation for over 10 billion years."

Among the researchers taking part in this project was Brian Mansfield, a graduate student who traveled to Chile to gain hands-on experience with the SOAR telescope.

However, much of this work was conducted at the remote observing facility on the first floor of the Biomedical and Physical Sciences Building on the MSU campus.

Other members of Beers' group at MSU who contributed to this project are postdoctoral fellow Sivarani Thirupathi and graduate student Young Sun Lee.

