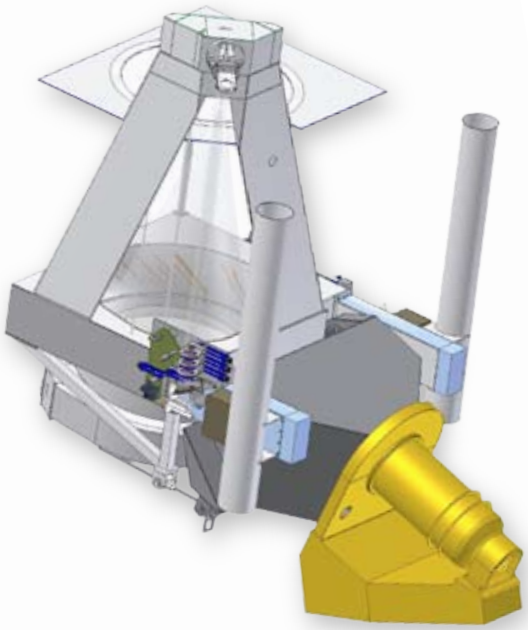


Above: Perspective drawing of the new BBSO telescope. Opposite: The smaller observatory dome houses instrumentation used for earthshine research. Subsequent to this photo being taken, the smaller dome was painted white to reduce interior heating.

BIG

AT THE EDGE IN SOLAR RESEARCH

The cool, calm water of Big Bear Lake in California's San Bernardino Mountains is a long way from the NJIT campus in Newark. But that's where NJIT operates one of the world's foremost solar-research facilities, on a narrow causeway jutting a thousand feet into the lake.

Big Bear Solar Observatory (BBSO) has produced a wealth of data about the Sun for many years, and the installation of a new state-of-the-art telescope promises even more fundamental knowledge about the star nearest to Earth. Insights into phenomena such as solar flares and coronal mass ejections have been especially significant. Particle streams from these violent events can damage satellites, endanger astronauts, and disrupt terrestrial telecommunications and power grids. Studying the relationship between solar phenomena and climate change is another area of major importance.

PHOTO BY ALLA SHUMKO

THE WORLD'S LARGEST GROUND-BASED SOLAR TELESCOPE PROMISES GREATER UNDERSTANDING OF HOW THE SUN AFFECTS LIFE ON EARTH, FROM TELECOMMUNICATIONS TO CLIMATE CHANGE.

BEAR

Prominent organizations around the world share in the work at BBSO and help NJIT maintain the observatory as a leading research facility. Educational institutions include the University of Arizona, the University of Hawaii, the Korea Astronomy and Space Science Institute and Seoul National University. The breadth of this support is a clear indication of how highly the scientific community values BBSO's contributions to solar science.

GREATER CAPABILITIES

BBSO now has the world's largest ground-based solar telescope, which replaces the instrument installed in the 1960s. The National Science Foundation has provided $2 million toward the approximate $5-million cost of the new telescope, with additional funding by the National Aeronautics and Space Administration, the Air Force Office of Scientific Research and the Korean Science Foundation.

Housed in a larger dome, the new telescope is an off-axis reflector with a primary mirror slightly more than five feet in diameter (1.6 meters). A major benefit of off-axis design is that the telescope's secondary mirror does not lie in the path of incoming light, allowing the Sun to be observed without obstruction.

LOOKING DEEP INTO SPACE AND THE FUTURE

Last spring, Distinguished Professor of Physics Philip R. Goode was awarded the first NJIT Board of Overseers Excellence in Research Prize and Medal for his achievements as an internationally acclaimed solar astrophysicist. The award was established by the Board of Overseers to increase awareness of outstanding research at NJIT.

Goode has played a key role in making NJIT's Big Bear Solar Observatory one of the world's primary centers for solar research. The staff has grown from 4 to 40, and the annual budget, supported solely by competitive grants, has risen from $500,000 in 1997 to more than $5 million. In addition, Goode was recognized for more than two decades of service to NJIT as an educator, especially for his contributions to building the university's solar physics program.

In his remarks, Board of Overseers Chairman Emil Herkert said, "Professor Goode looks deep into space toward the Sun, as well as toward the future. His work in solar physics, and his guiding role at the Big Bear observatory, are advancing our knowledge of the energy source that sustains all life on Earth. While he has received wide recognition for his leadership in this research, it is worthy of even greater acknowledgement."

PHOTO: MARK B. VINCENT

FURTHER STUDY OF THE SUN WITH A MORE CAPABLE INSTRUMENT WILL ENHANCE OUR ABILITY TO FORECAST "BAD WEATHER" IN SPACE.

PHOTO: ALLA SHUMKO

An elevation of more than 6,000 feet and the water surrounding the Big Bear observatory contribute to ideal viewing conditions at the site.

The Big Bear site is ideal because an elevation of 6,750 feet and the surrounding water reduce atmospheric turbulence that distorts astronomical images. These natural viewing advantages are augmented with various technologies in the larger telescope. They include an adaptive optics system that automatically compensates for atmospheric distortion. In combination, the features of the new telescope increase resolution by a factor of three compared to the old instrument.

MANY QUESTIONS

The quest for new knowledge at Big Bear is guided by NJIT Distinguished Professor of Physics Philip R. Goode, who was honored in March with the first NJIT Overseers Excellence in Research Prize and Medal. Goode directs BBSO activities as head of NJIT's Center for Solar-Terrestrial Research, whose mission includes fostering the integration of education and scientific discovery. Participation in real-world research is basic to the NJIT experience, and programs that include working with BBSO data offer exceptional opportunities for students at every level.

As fruitful as past research has been, the new telescope will help to answer many more questions when fully operational in 2009. "For example, we don't have a complete understanding of the complex processes that cause solar magnetic storms, and consequences that

THE EARTH'S REFLECTANCE IS AN IMPORTANT FACTOR IN THE NATURAL REGULATION OF TEMPERATURE WORLDWIDE.

include their terrestrial impact," Goode says. "Further study of the Sun with a more capable instrument will enhance our ability to forecast such 'bad weather' in space." These anticipated insights into space weather from BBSO will also complement a significant new NJIT initiative in this field — the work of the recently established Space Weather Research Laboratory (SWRL), to be directed by Distinguished Professor Haimin Wang and based at NJIT's Newark campus.

INVESTIGATING CLIMATE CHANGE

In addition to terrestrial telecom and power disruptions, BBSO is contributing to the investigation of climate change. As Goode explains, "There's a great deal to be learned about how long-term trends in solar activity influence variations in our climate on Earth." Goode has achieved wide recognition for his own work involving climate change, specifically the relationship between the phenomenon of earthshine and the reflectance of our planet's cloud cover. Earthshine is sunlight reflected by the Earth that is visible as a dim glow on the dark portion of the moon.

The Earth's reflectance is an important

SWRL

WANG HEADS NEW SPACE WEATHER LAB

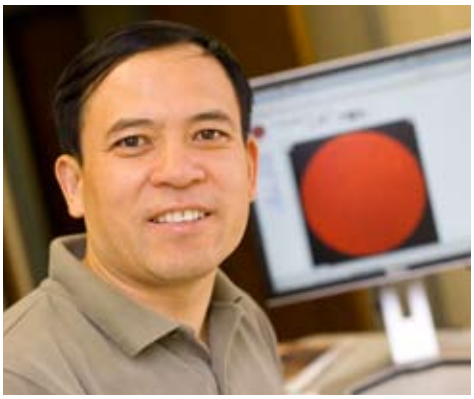
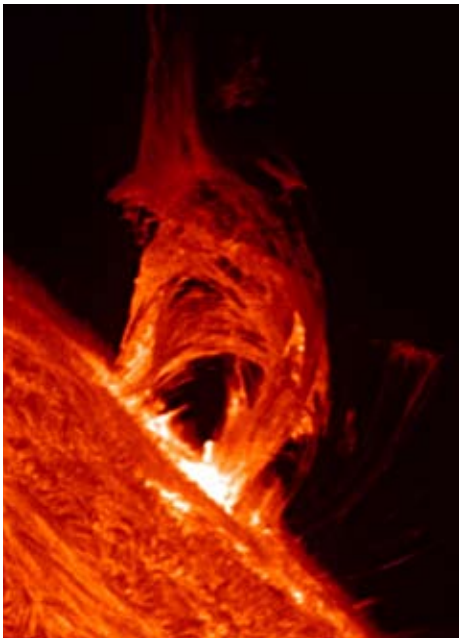


PHOTO: WINNIE YEUNG

In September 2008, NJIT created the Space Weather Research Laboratory (SWRL) and appointed Haimin Wang, distinguished professor in the Department of Physics as its founding director. Professor Wang has been associated with NJIT's Big Bear Solar Observatory since assisting with its acquisition from California Institute of Technology in 1997, and the new laboratory recognizes the tremendous growth in his specific research interests related to space weather.

SWRL's mission is to understand the magnetic activities of the Sun and their effects on the near-Earth environment. It will develop tools to monitor, understand and forecast solar activity and its geomagnetic effects. SWRL will manage and maintain the server for the current seven-station Global H-Alpha Network developed by Professor Wang that provides 24/7 monitoring of activity in the Sun's chromosphere.

SWRL also maintains the important mission of integrating research and education by training PhD students and post-doctoral researchers, preparing them to become future leaders in the solar physics community. SWRL is the newest member of the Center for Solar-Terrestrial Research at NJIT and will serve to integrate data from BBSO, NASA space missions, the university's Owens Valley Radio Observatory and other resources. This is a multi-discipline effort that encompasses solar physics, computer science and mathematics.



A massive solar prominence

factor in the natural regulation of temperature worldwide. Since 1998, Goode and BBSO colleagues have mined data from satellites and other sources to correlate terrestrial reflectance with earthshine. They have confirmed appreciable decadal variation in reflectance due to changes in the Earth's cloud cover, indicating that the mechanism and rate of climate change are even more complex than previously understood. Data acquired with the new BBSO telescope promises to advance this work, as well as investigation of how other solar phenomena may affect climate. ■

Author: Dean L. Maskevich is editor of NJIT Magazine.

STUDENTS AT THE FRONTIER OF CLIMATE RESEARCH

Astronomical data from Big Bear Solar Observatory and other sources is being put to good use by NJIT students as part of their engagement in the research experience. For undergraduate Mohammad Naqvi, an electrical and computer engineering major working in the Center for Solar-Terrestrial Research, analyzing Big Bear data paid a special dividend – being named a Goldwater Scholar by the Barry M. Goldwater Scholarship and Excellence in Education Program. Naqvi received this recognition and scholarship based on his climate-change research involving fluctuations in ultraviolet radiation from the Sun.

Mohammad's younger brother, Salman, is looking skyward as well. Recipient of the National Oceanic and Atmospheric Administration's Ernest F. Hollings Scholarship for 2008, Salman's research interests include the effects of urban growth on climate. Also an electrical and computer engineering major, Salman is working with Physics Professor Andrew Gerrard, affiliated with the Center for Solar-Terrestrial Research. Their plan is to study urban atmospheric influences related to climate using instrumentation added to the telescope that NJIT shares with the United Astronomy Clubs of New Jersey. (See "Seeing Stars at Jenny Jump," p. 2.)

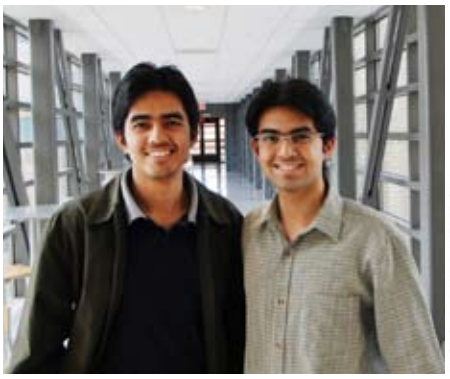


PHOTO: BABAJIDE AKEREDOLU

Salman and Mohammad Naqvi