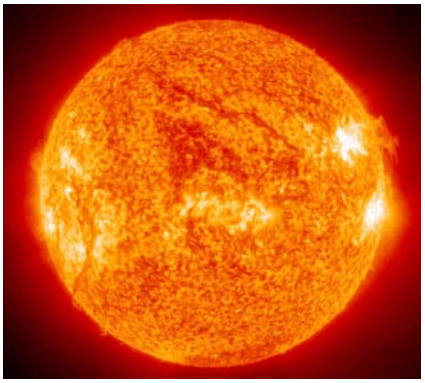
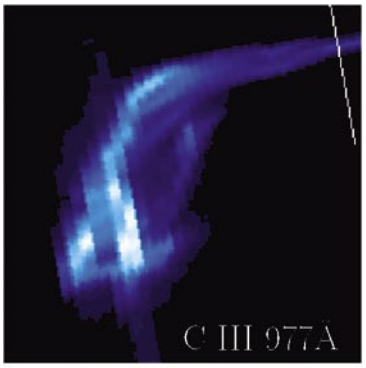
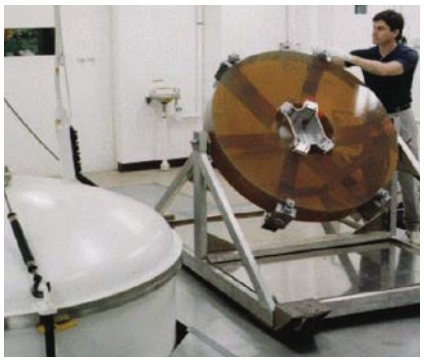
Smithsonian Solar Experiments Benefit from Unique NASA Goddard Facility







When researchers at the Smithsonian Astrophysical Observatory (SAO) needed a state-of-the-art coating on the optics used in their solar-laboratory experiments, they turned to the space-optics leader: NASA Goddard Space Flight Center. The unique coating provided by Goddard's thin-film coating facility allows SAO's mirror to reflect light over a wide range of wavelengths. Having this improved optic dramatically increases the efficiency of SAO's experiments, allowing researchers at SAO and at institutions throughout the world to rapidly acquire the atomic data needed to develop more accurate models of the solar atmosphere. This work was performed under a new type of Space Act Agreement (SAA)—that is, a Simplified SAA.

Benefits of Technology Transfer

- Goddard's optical coating is about twice as efficient as a commercial coating, allowing SAO's researchers to obtain data about four times faster.
- As a not-for-profit organization, SAO was not in a financial position to develop its own coating capabilities. Being able to access Goddard's facilities saved significant time and money.
- Performing this type of "work for hire" allows Goddard to maintain its state-of-the-art facility.
- By working closely with SAO as a partner, Goddard ensures that future optics needs of NASA and SAO are met.
- The first-ever Simplified SAA provides a template that allows for rapid review and approval of routine, low-cost, small-scope projects such as this.

tech transfer *success*

On the Record

"Goddard is the only place in the country that does this kind of coating. We could have tried to make do with a commercial coating, but they're significantly less efficient. If we weren't able to access Goddard's facilities, it would have taken us four times as long to get the data we need. It has a big impact on our ability to do the experiments." *– Dr. Larry D. Gardner, Physicist, Smithsonian Astrophysical Observatory*

"The Simplified Space Act Agreement represents a new, faster process for routine work of a limited scope. This template agreement can be routed through our legal and financial systems in a matter of weeks." *– Scott M. Owens, Optics Branch Technology Coordinator, NASA Goddard Space Flight Center*

About Smithsonian Astrophysical Observatory

Located in Cambridge, Massachusetts, SAO is a research facility of the Smithsonian Institution as well as a member of the Harvard-Smithsonian Center for Astrophysics (CfA). Founded in 1890, SAO includes a broad program of research into astronomy, astrophysics, and earth and space sciences by more than 300 scientists.

Technology Origins

Researchers in Goddard's thin-film coating facility developed an innovative coating that reflects a wide range of wavelengths of light, allowing for unprecedented imaging. The process begins with an aluminum (Al) coating that is protected by a top layer of magnesium fluoride (MgF_2). This protected coating provides excellent reflectance for wavelengths down to about 120 nm. In fact, optics with this coating have been used on dozens of NASA space flight missions, including Hubble Space Telescope.

At wavelengths below 120 nm, the MgF_2 layer on top becomes opaque. Goddard's researchers realized that boron carbide (B_4C), which is relatively transparent above 120 nm, can reflect light in the 50–150 nm range. Covering the protected aluminum coating with a thin layer of B_4C allows the mirror to reflect light efficiently from the red wavelengths down to the extreme ultraviolet (EUV) range.

Finding a New Use

Optics with reflectance over a wide wavelength range are essential for SAO researchers studying solar processes. Specifically, these researchers conduct laboratory experiments to study and measure cross-sections for electron impact excitation in multiply-charged ions. This process is the source for all light from the sun; however, most cross-sections for producing light in the EUV range are known only from theoretical calculations. Experimental data are needed to validate the theoretical methods, understand the processes, and explain the distributions in the intensities and wavelengths of the sun's light.

Such experiments require mirrors that can reflect and focus light over a wide range of wavelengths. Goddard's Al/MgF_2 coating process combined with its ability to provide the B_4C coating in the same laboratory would provide SAO with the mirrors it needed. A partnership for collaboration was the next logical step.

The Transfer Process

Having learned about Goddard's thin-film coating capabilities via articles in scientific journals, SAO researchers contacted their counterparts in Goddard's Optics Branch. The Office of Technology Transfer at Goddard developed the Simplified SAA, which was signed on February 6, 2006. SAO provided the optic and reimbursed Goddard for the thin-film coating services.

Looking Ahead

After testing at several wavelengths—from 70 nm to above 120 nm—in SAO's laboratories, the optic will be incorporated into the electron impact excitation experiment for measurements on twice-ionized carbon at 97.7 nm.

For More Information

If you would like additional information about Goddard's technology transfer opportunities, please contact:

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internet: **http://techtransfer.gsfc.nasa.gov**