Researchers examine Astro's universe

Last December, NASA launched the Astro Observatory, a shuttle-borne laboratory that carried two ultraviolet spectrographs, an ultraviolet camera and an X-ray telescope on a nine-day, Earth-orbiting mission. During Astro's problem-plagued flight, astronomers failed to get about 60 percent of the images and spectra they had hoped to obtain (SN: 12/8/90, p.356). But this week researchers reported that the data Astro did acquire revealed a wealth of new details about the composition and structure of the universe.

Because extreme ultraviolet and X-ray radiation cannot penetrate Earth's atmosphere, these wavelengths are detectable only from space. At the annual meeting of the American Physical Society in Washington, D.C., astronomer Theodore P. Stecher took his audience on an armchair tour of galaxies, supernova remnants and globular star clusters. The vistas and details that Stecher displayed had never before been fully imaged at such short wavelengths.

Stecher, principal investigator of Astro's only imaging instrument, unveiled the first ultraviolet portrait of the Crab nebula. It displayed regions where the supernova remnant's huge magnetic field accelerates electrons to high speeds, inducing the particles to emit synchrotron radiation. Astro's camera also revealed previously undetected features at the core of the globular cluster Omega Centauri, including the presence of some 1,300 blue stars. Even in visible light, detectors on Earth cannot image these hot stars. Intense, competing emissions from cooler stars in the cluster's core dominate the visible radiation, explains Stecher, of NASA's Goddard Space Flight Center in Greenbelt, Md. But the cooler stars fade in the ultraviolet, allowing warmer objects to step into the spotlight.

Stecher notes that thousands of hot stars in nearby galaxies such as Andromeda and the Large and Small Magellanic Clouds also made their ultraviolet debut on film from the Astro camera.

Astro's broad-band X-ray telescope found several novel features. The instrument, which cannot image objects but instead serves as a high-resolution X-ray spectrograph, clearly detected iron in hot gas throughout the relatively nearby Perseus cluster of galaxies, reports Peter J. Serlemitsos of Goddard. This refutes studies suggesting the metal concentrates at the cluster's center, he says.

Serlemitsos and his colleagues also determined the redshift of the X-ray spectra, indicating the cluster's distance – 224 million light-years from Earth. (According to standard cosmology, more distant objects move away at higher speeds and the light they emit gets shifted more toward the red, or longer-wavelength, end of the spectrum.) That measurement represents one of the first times that astronomers have used X-ray spectra, rather than visible-light spectra, to determine a redshift, he says. This method may prove especially useful in determining the distances of very far galaxies, he adds, because the visible light reaching Earth from these objects is often too faint for computing redshifts.

An observation with one of Astro's two spectrographs, the Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE), supports the notion that Seyfert type-I and type-II galaxies are actually a single class of galaxy, even though their unpolarized spectra differ.

Arthur D. Code and his co-workers at the University of Wisconsin-Madison used WUPPE to examine ultraviolet light emitted by the core of NGC 1068, the brightest known type-II Seyfert. They found that the light has a high polarization rate of 15 percent, which remains constant over many wavelengths. This indicates that electron clouds surround the dust-shrouded core, Code says. The clouds act like reflectors, polarizing radiation escaping from a small hole in the dust and sending some of this core light – which would otherwise go undetected – back toward Earth.

Unlike most radiation from type-II Seyferts, this polarized light appears to contain broad emission lines characteristic of type-I galaxies. Code says the new observations lend credence to a theory that the spatial orientation of some Seyferts causes radiation from their cores to travel through light-absorbing dust, preventing the light from taking a direct, unpolarized path to reach Earth. The dust would tend to suppress certain telltale spectral fingerprints – such as broad emission lines – that all Seyferts might share. *– R. Cowen*

Prostate screen: Blood test rates best

Men with prostate cancer face some grim statistics. About 30,000 die from this disease in the United States each year, in part because 70 percent of all cases go undetected until the malignancy has spread beyond the prostate gland.

A simple blood test – already used in prostate cancer patients to track their response to chemotherapy – now offers the best hope yet for early diagnosis, report William J. Catalona and his coworkers at Washington University School of Medicine in St. Louis.

Physicians today diagnose prostate cancer in a two-step process that involves checking for an enlarged prostate gland – traditionally by palpating the gland from inside the rectum – and then analyzing prostate cells removed from patients found to have an enlarged gland. Not only do many men avoid the uncomfortable rectal exam; the manual probing is also a very subjective procedure whose usefulness depends on the skill of the physician.

Catalona's group tried another approach: measuring blood levels of prostate-specific antigen (PSA), a protein produced exclusively by the prostate gland and present at elevated levels in men with prostate cancer and other prostate diseases. In the April 25 NEW ENGLAND JOURNAL OF MEDICINE, the researchers describe a study of more than 1,600 men aged 50 and older. The PSA test, they report, correctly identified 30 percent more prostate cancer cases than did rectal exams and uncovered 40 percent more cases than did an ultrasound scope, a new device used by some urologists to examine the gland visually. The authors have since screened more than 7,000 additional men, and the percentages reported in the paper "have held up really well," Catalona told SCIENCE NEWS.

His team also reports that the blood test yielded fewer false-positives than either of the other two screening methods, meaning that fewer men with high PSA levels turned out *not* to have cancer when their prostate cells were biopsied. The lowest error rate emerged from a combination of the PSA screen and traditional rectal exam.

"The rectal exam [alone] is not really as accurate as physicians thought it was," Catalona says. Pairing rectal examination with the PSA screen "has the potential to dramatically improve the detection of prostate cancer."

Scientists don't know yet whether earlier detection would improve survival rates for prostate cancer patients as it does for women with breast cancer, cautions Martin I. Resnick of University Hospitals of Cleveland. Many men who develop prostate cancer in their 70s or 80s will die from other causes, he notes. Resnick questions whether more sensitive screening and earlier intervention would truly benefit these men, especially since 25 percent of prostate cancer patients treated by surgery or chemotherapy become impotent and up to 10 percent become incontinent.

Next January, the National Cancer Institute will launch a 16-year study to determine the extent to which quarterly screening for prostate cancer could reduce death rates from the disease, says John K. Gohagan, who will lead the $60 million project. *– T. Walker*