

Astronomy

Dietrick E. Thomsen reports from Pasadena, Calif., at the meeting of the American Astronomical Society

New telescope for old

When the Multiple Mirror Telescope (MMT) was completed nine years ago, astronomers waited eagerly to see whether this most innovative of telescopes would really work. The MMT consists of six mirrors set on a single mount; among the questions were whether such a seemingly unwieldy thing could track and point accurately, and whether six mirrors could be made to throw their reflections into a single image.

The MMT's managers believe it has fulfilled all those expectations very well. But Frederick H. Chaffee Jr. of the MMT Observatory in Amado, Ariz., told the meeting that this does not deter them from planning to replace its six mirrors with a more conventional single one. The MMT can point to within 0.3 second of an arc, it can track objects across the sky to an accuracy of 0.1 second of arc, and after a great deal of work, its images can be coaligned and made to coincide as well as astronomers would like. Indeed, experience with the MMT has led the designers of the National New Technology Telescope to choose a multiple mirror design for that project.

In spite of the success, the six 1.8-meter mirrors of the MMT have the total light-gathering power of a single mirror of 4.5 meters diameter. When the MMT was planned, that was a large power; today, with people planning 8-, 10- and even 16-meter equivalents, it is rather ordinary. So the MMT's managers have decided to upgrade their capacity by replacing their six mirrors with a single 6.5-meter mirror to be mounted in the same frame that now holds the six.

Casting single mirrors of this size was technologically impractical when the MMT was planned. Now, thanks to development of a method of casting very light, large, single mirrors in a spinning furnace, pioneered by Roger Angel of the University of Arizona, single mirrors up to 8 meters across are possible. The MMT people expect Angel to cast their mirror in 1988, and they hope to complete the conversion by 1992.

New mirror for an old observatory

The first telescope mirror to be cast by the new University of Arizona spin-casting technique will be for one of Europe's oldest and most famous observatories, the Vatican Observatory of Castel Gandolfo, Italy. This 1.8-meter Vatican Advanced Technology Telescope, however, will not be set up in the Vatican Observatory's Italian headquarters. It is planned to be one of an international collection of telescopes to be built on Mt. Graham, near Willcox, Ariz.

Spectroscopic survey telescope

The spectrum of an astronomical object is something astrophysicists always want to have, often even more than a simple image of the object. By analyzing the object's light in its component wavelengths, they learn many things about its motions and the processes going on inside it. But spectra are always more difficult to get than simple images. Today, with heavy demands on available telescope time, astronomers find it difficult to get the spectra they want, particularly as more of them want large numbers of spectra as they survey large populations of stars or galaxies of a certain class.

To meet the evident need, Pennsylvania State University and the University of Texas are building a telescope to be dedicated to spectroscopic surveys. It will have a mirror put together out of 73 hexagonal segments to build up an effective light-gathering area 8 meters across. It will be simpler to build than most, as it will be movable in only one dimension and set with a fixed tilt in the other. Over time this arrangement will allow the telescope to survey a band of sky reaching 24° north and south of the 31° N latitude location of the McDonald Observatory in Ft. Davis, Tex., where it will be set up. "That's enough of the sky to keep us busy," says Daniel Weedman of Penn State.

Behavior

Feeding pigeons serial chunks

Pigeons usually leave their mark on public statues and park benches, but they have now left their mark on the study of a basic principle of human memory. Lists that can be organized into memorable units or "chunks" are easier for people to remember, and psychologist Herbert S. Terrace of Columbia University in New York City reports in the Jan. 8 NATURE that pigeons possess a similar, nonverbal capability. Since a bird does not need language to engage in memory chunking, Terrace says it "is a more primitive and biologically pervasive cognitive process than has been recognized previously."

In initial trials, he trained 25 pigeons to receive a reward of food by pecking five colors or shapes in the correct sequence. The task, says Terrace, is comparable to many instances in which humans use rote memory, such as punching in a seven-digit number on a pushbutton telephone. Lists in which colors and shapes were clustered into chunks were learned twice as rapidly as lists consisting only of colors or containing interspersed colors and shapes. After learning a sequence, the pigeons were much better at recognizing the correct order of an internal pair of symbols that bridged two chunks than the correct order of an internal pair from a single chunk.

Although pigeons appear to memorize experimentally presented symbols in chunks, Terrace says it is not known if an animal can chunk items that are not organized into patterns by a researcher.

Eye of the (emotional) storm

The 41-year-old carpenter had been, in his own words, "happily married." But then his wife unexpectedly spent the night out, eliciting in him a wave of rage and jealousy fueled by his certainty that she had had an affair. Two days after the traumatic incident, he lost the vision in one eye.

His eye problem was not "all in his head" — he had a disorder known as central serous chorioretinopathy, in which vision is reduced because of a detachment of the retina at the area of most acute vision. Although its causes are unknown, this problem predominantly occurs among men aged 30 to 50 years, and in most cases the retina reattaches and good vision returns after several weeks or months.

In a study of 33 people with central serous chorioretinopathy, including the aforementioned carpenter, researchers have found that 30 had a very distressing psychological experience in the hours or weeks preceding the first loss of vision. A marital crisis, loss of a lover or work crisis were most often reported in clinical interviews, say psychiatrist Gary S. Gelber and ophthalmologist Howard Schatz of the University of California at San Francisco. Among the 16 subjects who had high blood pressure and the 23 who had tension-producing personality traits such as extreme worrying, perfectionism and hostility, central serous chorioretinopathy sometimes followed only moderately distressing episodes, they report in the January AMERICAN JOURNAL OF PSYCHIATRY.

Chronic high blood pressure or blood pressure jumps during successive incidents of stress may weaken capillaries near the retina and increase the likelihood of developing central serous chorioretinopathy, suggest the researchers.

Vision loss, they note, is not a direct result of the personality traits observed in some patients. The traits tend to stoke up daily tensions, emotional distress and physiological arousal. "These in turn may set in motion retinal vascular and blood pressure changes that predispose the individual to central serous chorioretinopathy," propose Gelber and Schatz.

Fifteen patients experienced recurrences of the eye problem several minutes to three days after new psychological disturbances, they add. The disturbances were not as severe, however, as those that had preceded the initial vision loss.