

...Stars

modes of oscillation at present, with periods of 460 and 540 seconds. Two other hot stars discovered by Green, Grauer, Howard E. Bond of LSU and James W. Liebert at Steward also show more than one mode of pulsation, with similar periods.

These stars are probably further along in their development than the unusual fourth member of this class, K1-16, recently analyzed by Bond and Grauer. The relative youth of K1-16 is revealed by the thin, but still visible, planetary nebula that envelops the central star and by its longer primary pulsation period of 28.3 minutes.

Hugh M. Van Horn of the University of Rochester in New York and his co-workers report in the June 30 *NATURE* that theoretical simulations of the thermal and physical structure of these stars indicate that changes in their periods as they age may be observable in as short a time span as 1 to 3 years. The exact mechanism driving the oscillations is not understood, but may be linked to ionized layers of material beneath the stellar surface. In a kind of feedback process, observations of period changes will serve to update and improve current stellar models. Since the rate of change of the period is also a measure of the hot stars' cooling by neutrino emission, it is possible, says Van Horn, that future astronomical observations may even provide a test for theories that govern the interactions of elementary particles.

—P.D. Sackett

...Ocean

mediately forthcoming. "I think," he said as he left the speaker's platform, "we have an interesting new world to play with in the next few years."

Ironically, even as Cruikshank spoke, some other researchers at the same meeting were worrying about the state of future opportunities to study Triton. In 1989, the Voyager 2 spacecraft is scheduled to fly by Neptune and its newly fascinating moon (depending upon the trajectory selected for the probe's 1986 flight past Uranus), but there has been some recent concern about whether NASA's tight funding will permit the full range of scientific observations to be conducted. The issue is under study.

The other leading candidate for an ocean, meanwhile, continues to be Titan. Liquid methane has been proposed for Titan by several research groups, but two recently published analyses have concluded that global methane oceans on the gigantic satellite are unlikely, possibly permitting only small patches on the surface if anything (SN: 7/9/83, p. 28). At the Cornell meeting, however, Jonathan I. Lunine and colleagues from California Institute of Technology in Pasadena proposed that Titan may have a global ocean consisting largely of ethane, with only about 25 percent methane and 5 percent nitrogen. A question is whether photolysis of methane (a source of ethane) would instead be tied up in producing the brown, organic "goo" that some other researchers believe lies thick on the surface. —J. Eberhart

VDTs: User stress and eyestrain largely due to job design

The government estimates that more than 7 million U.S. workers spend a sizable fraction of their business day at video-display terminals (VDTs)—those television-like screens for displaying computer-processed data. Recently, VDT-induced visual fatigue, especially among clerical workers, has reached dramatic proportions: Surveys show that between 40 and 80 percent of all occupational VDT users complain of eyestrain and other symptoms of stress.

The National Academy of Sciences (NAS), asked to ferret out why, has just completed a two-year study. Summarizing its findings this week, study chairman Edward Rinalducci said, "We suspect that many of the complaints about VDTs are from workers in ... poorly designed jobs. Let me stress here that we feel the problem is with job design, not the VDT."

According to the NAS study panel, "Most features of VDT work tasks that may contribute to discomfort or visual difficulty are also found in various jobs not involving VDTs; however, poorly designed VDTs, workstations, and work tasks often produce a particularly problematic concatenation of adverse features."

The conclusions were based partly on an NAS symposium in August 1981 (SN: 8/29/81, p. 137), where labor leaders described the type of working conditions associated with the highest frequency of complaints involving vision and stress. Here VDT operators, usually female clerical workers, were required to quickly perform highly repetitive tasks, with no opportunity to vary either their work's structure or its pace. In the worst cases, supervisors monitored the daily productivity of respective workers by comparing the number of keystrokes tapped out on each

worker's keyboard as that worker manipulated displayed information.

That is a very stress-provoking environment, observed panel member Robert Guion. "I don't think there's anything that the person who has that job can do to make it one I would consider bearable," the industrial psychologist from Bowling Green University in Ohio added.

In most cases, it should be possible to design VDT-related jobs so that the work experience is both satisfying and productive. However, the NAS panel found, few jobs are, in fact, really "planned." Moreover, it said, whatever planning does occur is usually more involved with accommodating VDT equipment than its operators. And that, the NAS panel points out, is probably the mistake underlying much, if not most, of the symptoms plaguing VDT users today.

The NAS report does acknowledge that for some smaller proportion of workers, ill-chosen VDT equipment can itself be a serious problem. "What we have had," said panel member Harry Snyder at a press conference in Washington, D.C. last week, "is the misapplication of commercial television-receiver technology to the VDT environment." The industrial engineer, from Virginia Polytechnic Institute and State University in Blacksburg, pointed out that though cathode-ray tubes (CRTs) used in television receivers offer an inexpensive, off-the-shelf display technology for VDTs, they were never designed for close visual inspection. In fact, he noted, CRTs "were designed specifically to be viewed at a minimum distance equal to four times the height of the picture. For a 10-inch high CRT screen, that would be a distance of 40 inches. Yet most VDT systems using CRT technology have been designed so that

users sit a mere 15 to 18 inches from the screen, he says.

Frequently aggravating the visual environment, he adds, has been the past use of screens that were both prone to flicker and insufficiently shielded from the glare of office lighting or incoming sunlight. Many screens compounded the eye's already difficult workload by offering poor image contrast and difficult character resolution.

Particularly because the incidence of low-grade visual discomfort has been so high among VDT users, there has been growing concern about whether permanent eye damage might develop. But, the NAS study reports, "We find no scientifically valid evidence that use of VDTs per se causes harm ... to the visual system." In fact, it notes, levels of radiation required to induce cataract formation "are thousands to millions of times higher than the levels emitted by VDTs."

Because it was limited to reviewing VDT risks to vision, the study makes only passing reference to the anecdotal reports which have surfaced in the past few years linking high rates of abortion and miscarriage with VDT use.

But this report is by no means the last wordson that or any other aspect of VDT risks. The National Institute for Occupational Safety and Health, for instance, has just entered into an epidemiological study involving more than 5,000 women. It will examine, among other things, whether and how VDT use affects pregnancy. Meanwhile, researchers at the University of Texas in Austin have just begun a \$382,000 study, funded by IBM Corp. It will be looking for physiological changes in VDT operators that might serve as an objective measure of visual fatigue. —J. Raloff