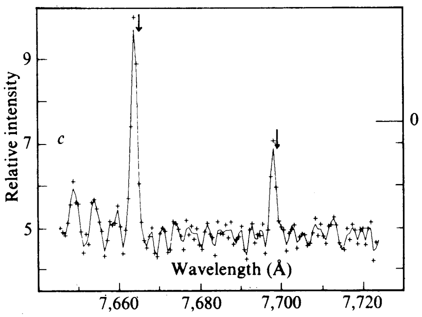
SPACE SCIENCES

Potassium in Io's cloud



The huge, gaseous clouds of sodium and hydrogen surrounding Jupiter's satellite Io have not been found to contain a third ingredient: potassium. Lawrence Trafton of the University of Texas at Austin has recorded postassium spectra from the clouds using the 107-inch telescope at the university's McDonald Observatory.

Observational and theoretical evidence suggests that the hydrogen and sodium clouds are not the same, and Trafton suggests, in the Dec. 25 Nature, that the potassium belongs to the latter category. The hydrogen cloud extends along a major arc of Io's orbit, and one theory holds that it may result from protons, trapped in Jupiter's magnetic field, being neutralized when they hit the surface of Io. The sodium cloud, although it envelops the entire Jovian system, is brightest near Io and its orbital plane. Trafton says it may be due to sputtering caused by charged particle impacts.

A current question is why the only constituents so far detected in Io's cloud(s) are alkali "metals" with valences of +1. One possibility is that the surface of Io, from which the sputtering takes place, is simply enriched in those elements, but that requires explaining why it would be enriched relative to solar, lunar or meteoritic abundances.

Trafton suggests another possibility. Laboratory experiments by others (Cassidy and Hapke, Icarus 25:371) have shown that sodium and potassium "are hardly adsorbed on surfaces they impact," while other elements are selectively adsorbed in direct proportion to their atomic weight. They have theorized that Io's surface microstructure may be rough enough for multiple scattering of the sputtered products to occur, thus leading to a cloud rich in sodium but poor in other elements. Trafton's potassium spectra support this. (The ratio spectrum shown corrects for the effect of earth's atmosphere.) He suggests that the effect of a possible plasma sheath on ionized sputtered products could enhance the potential for multiple scattering by minimizing the portion of the initial sputtering products that is directed away from the satellite's surface.

Fishing by satellite

Data from the Landsat earth-resources satellite have indicated that it may be possible in the future to spot productive fishing grounds from orbit, according to Alan E. Strong of the National Oceanic and Atmospheric Administration.

For the first time, chlorophyll concentrations have been detected in surface waters by satellite, by using their characteristic infrared "signature." Measured over the Great Lakes, the chlorophyll indicates the presence of large numbers of algae, a good sign of the likely presence of feeding fish.

Strong, who reported the satellite observations last month at the fall meeting of the American Geophysical Union, says so far it is only possible to detect chlorophyll in relatively high concentrations of algae. Future satellites such as Nimbus G, however, are expected to enable detection of lower algae concentrations, as well as more precise quantitative measurements. Strong's research also corroborates other NOAA studies that have found successful fishing to be in areas where upwelling, subsurface waters mix with warmer surface waters.

PHYSICAL SCIENCES

X-rays and stars

The Netherlands is a country without mountains and with a lot of cloudy weather, yet Netherlanders have been prominent in astronomy for generations. Thus it is not surprising that the first Dutch venture with an X-ray astronomy satellite of their own, the Astronomical Netherlands Satellite, should record a number of interesting results.

The two current reports concern X-ray emission from stellar coronas and the first observation of X-ray emission from flare stars (Astrophysical Journal 202:L67 and L73).

X-rays in the energy range between 0.2 and 0.284 kilo-electron-volts were observed from the coronas of Capella and Sirius. Emission, if any, from 26 other stars (including main sequence, subgiants, giants and supergiants) was below the detection limit of the equipment. Both of the detected stars are multiple systems, and the observers go on the assumption that the X-rays are from a hot corona surrounding the primary giant in the system. They derive formulas for its relevant characteristics.

X-ray flares were detected from YZ Canis Minoris (at 0.28 keV and between 1 and 7 keV) and from UV Ceti (0.28 keV only). The UV Ceti flare is known to coincide with a large optical flare; no optical or radio coverage of YZ Canis Minoris was available at the time. The observers conclude that flare stars are a new class of variable X-ray sources, although their luminosity is low.

Quasifission and energy

When nuclear physicists began to strike heavy nuclei against each other in heavy-ion accelerators, they expected that projectile and target would fuse into a new compound nucleus, and the compound nucleus would then fission according to its own internal dynamics, producing two new fragments. What the physicists found instead was mostly what is called quasifission: Target and projectile form a momentarily bound system, but it seems to remember what the original nuclei were. When it splits, its fragments tend to reproduce the projectile and target.

A recent experiment at the ALICE facility at the Institute of Nuclear Physics at Orsay, France, was aimed at determining what happens to quasifission as the energy of the projectile increases (B. Tamain, et al in the Jan. 5 Physical Review Letters). They struck copper 63 ions of 443 million electron-volts energy against gold 197 targets and compared the results with those obtained with the same target and projectile at an energy of 365 million electron-volts.

They wanted to find out whether the energy of the quasifission fragments depends on the energy of the projectile, or putting it another way, whether the relative energy of the projectile and target is completely damped at both energies. They found that the motion is completely damped at both energies. At the higher energy they also found more evidence for instances of complete fusion and fission than at the lower, as well as evidence that the nuclei orbit one another.

NP 0532 does it again

The Crab nebula pulsar, NP 0532, suffered a third glitch or sudden speed-up of pulse rate on Feb. 4, 1975. In the Dec. 25 Nature Eckmar Lohsen of the Hamburg Observatory analyzes the data, which he says are very good for comparison with theoretical models since the jump in frequency was at least three times that of the first glitch.

Glitches are attributed to starquakes in the solid crust of a neutron star with a superfluid interior and are prime observational support for such a model. Lohsen concludes that the parameters of the latest glitch fit the starquake model well.