PHYSICAL SCIENCES

What's behind quasar outbursts

In the complicated business of working up a model of what kind of objects quasars are, suggestions about the mechanisms that produce the light and radio waves they emanate are particularly important. Of especial use are sudden sharp outbursts of radiation. If the same outburst is observed in, say, light and radio, the time relation between the two can tell much.

An observation of this kind of the quasar 0420-01 by W. A. Dent and T. J. Balonek of the University of Massachusetts and A. G. Smith and R. J. Leacock of the University of Florida is reported in the Jan. 1 ASTROPHYSICAL JOURNAL LETTERS. It concerns an optical outburst followed by its radio counterpart 2.2 years later.

Previous observations of simultaneous radio and optical outbursts in other quasars had led to the following scenario: A puff of energetic electrons coming out of the heart of the quasar produces radio by synchrotron emission (that is, as a result of the electrons orbiting in the quasar's magnetic field). Some of the radio photons then collide with electrons, and in the collision their frequencies are altered into the visible light range (the process called inverse Compton scattering).

In this case, Dent and collaborators conclude, the inverse Compton model doesn't apply. That the light comes first and the radio much later indicates, they say, that the energetic electrons produced the light by synchrotron radiation, then moved farther away to a place where the magnetic conditions were different and produced the radio.

QCD: Still QED but moving along

Quantum Chromodynamics (QCD) is the theory of the behavior of quarks and of the force that animates them. Quarks are believed to be the constituents that make up most of the subatomic particles (protons, neutrons, etc.).

QCD can be studied by striking high-energy protons (in the hundreds of billions of electron-volts) against targets. Some debris from these collisions comes off perpendicular to the direction of the protons, and from these transverse products data relating to QCD can be found. An experiment done at the Fermi National Accelerator Laboratory struck protons against beryllium nuclei in an attempt to test two models calculable from QCD, the "constituent interchange model" (CIM) and the quantum chromodynamic parton model" (QPM). Both models assume that protons and neutrons have quarks or quark-like constituents inside them, but differ slightly as to behavior, QPM being more or less a refinement on CIM. A group of 21 physicists from SUNY at Stony Brook, Columbia University and Fermilab (H. Jöstlein et al.) report in the Jan. 15 PHYSICAL REVIEW LETTERS that although the calculations for CIM are unfinished, the data do seem to fit QPM.

Laser fusion: It's the pits

The intention of laser fusion experiments is to induce thermonuclear fusion by crushing and heating a pellet of fuel by hitting that pellet simultaneously with several beams of laser light.

In detail, when the light hits the surface of the pellet, it ablates some of the material, forming a layer of plasma or ionized gas. The back reaction from this plasma formation implodes the rest of the pellet. In the Jan. 15 PHYSICAL REVIEW LETTERS C. Randall and J. S. DeGroot of the Lawrence Livermore Laboratory point out that calculations of the efficiency by which energy is absorbed from the laser light by the ablated plasma have been based on unfocused plane waves. If the light is focused, they calculate, it will make craters in the surface of the pellet. These craters will refract the light, enhancing absorption by a factor of two or three (from 15 percent to between 30 and 45 percent).

BIOMEDICINE

Cancer with a pedigree

Although a witch hunt is currently being waged against cancer-causing chemicals in the environment, a report in the Jan. 19 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION provides a reminder that genes, not chemicals, are the culprits in at least some human cancers.

William A. Blattner of the National Cancer Institute and his colleagues first came across something rare and strongly suggestive of a genetic predisposition to cancer — three young siblings afflicted with three different kinds of cancer. The researchers studied the genealogy of the family to see whether they could learn more about its genetic predisposition to cancer. With the help of family interviews, courthouse records, census data, death certificates and hospital records, they managed to obtain information about the family's health dating back to the mid-19th century. Their data revealed 16 cases of cancer among four generations, including brain tumors, leukemia, breast cancer and sarcomas. What's more, the pattern of cancer occurrence among the family members suggested that whenever a member possessed a gene for cancer susceptibility, it was usually passed on to the offspring regardless of sex, and it in turn was capable of producing many effects.

A biological defect underlying obesity

It has long been known that damage to the hypothalamus — a cluster of cells tucked away in the brain — results in obesity, suggesting that some biological defect underlying obesity might reside in the hypothalamus. Now that defect may have been found, according to a report in the Jan. 5 SCIENCE by Eugene Straus and Nobel laureate Rosalyn S. Yalow of the Veterans Administration Hospital in New York City.

Over the years, work from a number of laboratories has suggested that a nerve-regulating chemical in the brain, and especially in the hypothalamus, might influence appetite regulation. It is called cholecystokinin (CCK). Straus and Yalow compared concentrations of immunoreactive CCK in brain extracts from genetically obese mice, their nonobese littermates and normal mice of another genetic strain. And, as they report, CCK in the brain of the obese mice averaged about one-third that of their nonobese littermates and one-fourth that of other normal mice. "These findings are suggestive of a causal relationship between the diminished brain immunoreactive CCK content and the unrestrained appetite of the obese mice."

Could CCK injections help obese people lose weight? Some animal evidence suggests that it might. More than a decade ago researchers showed that injections of enterogastrone, a preparation now known to be rich in CCK, caused reduced food intake in mice, whereas other chemicals did not. Subsequently several groups of investigators have shown that injections of purified CCK can elicit satiety-like behavior in several animal species.

Preventing crib deaths

Infants with near-fatal attacks of crib deaths due to apnea (breathing difficulties) or with a family history of crib deaths due to apnea can possibly be helped with electronic monitors that sound a loud beep when the infants stop breathing. So report Daniel C. Shannon and Dorothy Kelly of the Massachusetts General Hospital in Boston.

The parents of 260 babies known to be at risk of crib death due to apnea were given monitors and trained in how they should respond to their infants if the monitors went off. Sixty percent of the infants had major breathing difficulties while hooked up to the monitors, and the monitors helped save the lives of all but four of these infants.