Physical Sciences Notes

ASTROPHYSICS

Strangest of the Strange

The quasar designated PKS 0237 minus 23, previously reported to have two different red shifts depending upon how its speed of recession is measured, has now been reported to have the greatest known red shift. (SN:2/4).

Its composition has also been analyzed and several heavy elements, such as titanium and sulfur, have been detected, another way in which it differs from known quasars.

Red shifts are generally interpreted to mean that the source is receding from the observer. If this is true for quasars, then PKS 0237 minus 23 is receding from earth at more than 150,000 miles a second, or 82.4 percent of the velocity of light. This is one percent faster than the greatest red shift previously measured.

The quasar was discovered and its location pinpointed by Dr. John G. Bolton with the 210-foot radio telescope at Parkes Radio Astronomy Observatory in Australia. The red shift and chemical composition were measured by Dr. Halton C. Arp of Mt. Wilson and Palomar Observatories using the 200-inch Hale telescope and by Dr. T. D. Kinman using the 120-inch instrument at Lick Observatory.

The scientists report scientific details to their colleagues in the current ASTROPHYSICAL JOURNAL.

RADIOACTIVE DATING

Art Works Dated Atomically

Radioactive dating of works of art by measuring the alpha particles emitted by the lead contained in the paint, pewter or bronze has been found a valuable way of distinguishing between originals and forgeries.

Scientific tools of increasing sensitivity and sophistication have been used to examine the materials of art and archaeology and to support judgments concerning authenticity. However, as forgers become acquainted with new methods, they learn how to circumvent them.

No circumvention is possible with the method based on detection of radioactive lead 210, since it disintegrates with a half-life of 22 years unless its long-lived precurser, radium 226 is present.

The catch is that the radium is separated chemically from lead when lead and its products are prepared from the ore.

The paint sample must be white lead of high purity for the method to work, Dr. Bernard Keisch, now of Mellon Institute in Pittsburgh, and his co-workers there and at Nuclear Science and Engineering Corporation, Pittsburgh, report in the March 10 SCIENCE.

The method has been suggested and tested previously but no instruments capable of distinguishing between the concentrations of radium 226 and its descendants were available then.

SOLID STATE PHYSICS

New Source of Millimeter Waves

The discovery of a new mode of oscillation for gallium arsenide diodes now makes possible solid state oscillators that operate at higher frequencies, and with higher power at any freqency, than such other solid state devices as transistors or tunnel diodes.

The new mode is called LSA, for limited space-charge accumulation. It was first theoretically predicted and then experimentally verified by Dr. John A. Copeland of Bell Telephone Laboratories.

LSA oscillators are not subject to rapidly decreasing powers at millimeter wavelengths, a characteristic previously thought to be a fundamental limitation of all solid state oscillators.

With LSA diodes, Dr. Copeland has obtained at room temperature continuous wave power of 20 milliwatts at 80 billion cycles a second, the highest frequency ever reported for an oscillator of this type.

NUCLEAR PHYSICS

Nuclear Shape Accurately Measured

The shape of a nucleus, that of the element indium, has been measured to a higher degree of accuracy than previously possible by scientists at the National Bureau of Standards in Boulder, Colo., and the University of Colorado.

The indium nucleus can be said to have a surface resembling a football with a tight belt tied around its center, their experiments showed. The Colorado scientists experimentally detected nuclear hexadecapole transitions, which had been predicted but not previously observed.

A hexadecapole consists of 16 poles arranged in one, two or three dimensions. In a nucleus, the electrical hexadecapole is simulated by three-dimensional distributions of charge. The electrical hexadecapole moment gives a measure of this distribution, and is determined by observing transitions between different energy states of the nucleus.

The first observations of hexadecapole moment were made by R. J. Mahler and L. W. James of the NBS Radio Standards Laboratory and W. H. Tanttila of the University of Colorado.

SOLAR SYSTEM PHYSICS

Cosmic Ice Suspected in Australia

Part of the gas escaping from holes drilled in Australia's Northern Territory came from a comet that collided with earth some 130 million years ago, Dr. K. A. W. Krook of Australian National University, Canberra, believes.

The gas was observed to blow from 19 shallow shot holes during a recent seismic survey of Gosses Bluff. The "striking feature of the gas occurrences is that the gas was detected only after a charge had been fired," Dr. Krook reports in the March 11 NATURE.

Since fracturing of the rock by explosion is evidently necessary to release the gas, he suggests that the most likely source is the dissemination of gases in the head of a comet striking earth.

Some of the cosmic ice, as well as air under high pressure, would be driven into the shattered rock within and around the impact site. Entrapment would occur when the material settled following the explosion.

Dr. Krook checked the possibility of cometary origin for the gas by calculating the probability of impact between earth and a comet, and by comparing the proportions of such gases as nitrogen, ammonia and hydroxyl with the observed composition of comets. He concludes that the results indicate a "significant part of the gas encountered" is cometary in origin.