Quasars: New evidence for cosmological distances

Quasars or quasistellar objects are a decade-old astronomical mystery. They are objects that look as if they have dimensions comparable to stars and yet radiate energy in both radio and visible light that outdoes most galaxies.

Quasars also appear to be the most distant known objects in the universe. Their light reaches earth very strongly shifted to the red end of the spectrum. This red shift is the standard way astronomers measure velocity of recession and, therefore, of the distance of galaxies: the greater the red shift the greater the distance.

If the quasar red shifts are accepted as a representation of distance, quasars are the most distant objects known. They, therefore, are also some of the oldest and can give important information about the history of the universe. But there is a counterargument: A strong gravitational field can cause a red shift in light emitted from the midst of it. The apparent dimensions and energy output of quasars give grounds for believing that they are very dense and massive and have strong gravitational fields. This would mean that a large part of a quasar's red shift might be due to gravity and that quasars may therefore be much nearer than they seem to be.

This week new evidence for placing quasars at cosmological distances—as opposed to more nearby areas of the universe—is presented in the March 15 ASTROPHYSICAL JOURNAL by Dr. James E. Gunn of California Institute of Technology. On pictures taken with the 200-inch Hale telescope of the Palomar Observatory, he finds that the quasar Parkes 2251 + 11 in the constellation Pegasus appears to be associated with a cluster of galaxies. The red shift of the quasar and that of the brightest galaxy in the cluster are the same.

The chances that this is a coincidence are very small, in his opinion. He believes that the quasar is associated with the cluster and is, therefore, at generally the same distance, about 3 billion light years. Since galaxies are not dense enough to have noticeable gravitational red shift, this would mean that quasar red shifts are also reliable measures of distance and would place the known quasars at distances ranging from 1 billion to 10 billion light years.

The finding is also indirect evidence for big-bang theories of cosmology. If the red shifts do measure distance, then there are many more distant and, therefore, old quasars than nearby ones. If more quasars were made in the early history of the universe than later, that fact argues for a changing or evolutionary universe as proposed by big-bang theories and against an unchanging or steady-state universe as proposed by objectors to the big bang.

Dr. Halton C. Arp of the Mt. Wilson and Palomar Observatories disagrees. He said this week that he cannot see that this quasar belongs to a cluster. Furthermore he said the known quasars tend not to be associated with known rich clusters of galaxies. He believes quasars are much nearer the earth, and if they associate with clusters, the clusters are too near to be seen as clusters in the sky.

Dr. Gunn replies that part of the argument is over the definition of a cluster. His is not a rich cluster, but a sparse one of 20 or 30 members. He maintains that even if only the one galaxy has a red shift equivalent to the quasar's, the fact that they are so near each other in projection on the sky would still be highly significant. Furthermore there seems to be a physical connection between the quasar and the galaxy. In addition to starlight the galaxy shows radiation from hot interstellar gas. If the quasar is really near the galaxy, its radiation could be exciting the gas, and Dr. Gunn says a rough calculation shows the amount of heat is about right. □

Toward correction of genetic defects

In 1965 Dr. Henry Harris at the University of Oxford reported that he had successfully overcome the natural antibody mechanism of cells and fused together the cells of mice and men (SN: 3/20/65, p. 182). In 1966 he reported further success in the production of hybrid cells (SN: 4/16/66, p. 259). Over the years this type of genetic manipulation has been responsible for great hopes and great fears in many people. Geneticists envisioned a future for gene manipulation that would enable them to correct for cell deficiencies and mutations. Some members of the general public, on the other hand, foresaw a future in which gene manipulation would be a tool in the hands of ruthless men who could control the world by creating superspecies and subspecies of men.

It will be many years before these fears, expressed in Aldous Huxley's "Brave New World," have any foundation. But Dr. Harris and his Oxford colleagues, Drs. A. G. Schwartz and P. R. Cook, report in the March 3 NATURE that they have taken what seems to be an important step in the field of genetic control.

They have discovered that it is possible to transfer genetic information from one type of cell to another type of defective cell, thereby correcting for a genetic deficiency in that cell. Using a certain type of mouse cell, deficient in the enzyme inosinic acid pyrophosphorylase (IAP), and the red blood cells of embryonic chicks, they have produced a hybrid mouse cell which has the power to synthesize the previously absent IAP.

The erythrocite, or red blood cell, of chicks has a nucleus in which the genetic functions are switched off. By fusing this cell with the mouse cell, a new, or hybrid, cell is formed which contains the nuclei of both cells. When this multinuclei cell reproduces, only the original mouse nucleus survives. The chick nucleus breaks up in a process described as "chromosome pulverization." The daughter cells, those resulting from the reproduction of the original multinuclei hybrid, have only one nucleus, like the original mouse cell, but they have been exposed to