

# A Supermassive Object in Galaxy M87

The galaxy in the constellation Virgo that the eighteenth century astronomer Charles Messier listed as number 87 in his catalog of "nebulae" has become a famous and much-observed object. A member of the nearest cluster of galaxies to our own, the Virgo cluster, it is also known to optical astronomers as NGC 4486. Identified as the optical counterpart of one of the earliest discovered radio sources (Virgo A) it has long been of interest to radio astronomers.

M87 is of particular interest because it is peculiar. It is an elliptical galaxy of the EO class, but it radiates more energy than galaxies of that class usually do,  $2 \times 10^{42}$  ergs per second of "anomalous" energy output. Radio evidence shows that the nucleus of M87 is energetically active, and there is also optical evidence for such activity in the form of jets that seem to be matter ejected from the nucleus.

All in all, it seemed to two slightly overlapping groups of astronomers that M87 was a good place to look for evidence to support a theoretical idea (attributed to D. Lynden-Bell of Cambridge University) that the centers of active galaxies, radio galaxies and quasars are inhabited by supermassive black holes. The gravitational collapse of matter falling into such a black hole would supply the energy for the various goings-on that are observed. The conclusion of the two parallel studies of M87, as published in the May 1 *ASTROPHYSICAL JOURNAL*, is that there is indeed a supermassive object in the nucleus of M87, which could be a black hole.

The presence of such an object was determined by studying the distribution and velocities of stars in the galaxy, particularly in the immediate neighborhood of the nucleus. The stellar distribution study, which is a study of variations in brightness over the surface of the galaxy looking for a bright central "cusp" of stars bound to the heavy object, was done by Peter J. Young, James A. Westphal, Jerome Kristian and Christopher P. Wilson of the Hale Observatories and Frederick P. Landauer of the Jet Propulsion Laboratory. They used the 60-

inch and 200-inch telescopes on Mt. Palomar.

The velocity study, which is a spectroscopic study of the velocity dispersion or the range of velocities that the galaxy's stars exhibit with respect to one another, was done by W. L. W. Sargent and Young of the Hale Observatories, Alec Boksenberg and Keith Shortridge of University College, London, C. Roger Lynds of Kitt Peak National Observatory and F. D. A. Hartwick of the University of Victoria (British Columbia). The point is to look for a velocity dispersion that is larger than usual. This testifies to the presence of an unusual amount of mass in the galactic center, because the greater the velocity distribution, the more mass has to be there to hold the stars in. This second group did their observation of M87 with the 4-meter telescope at Kitt Peak and observations of NGC 3379, which they use as a "normal" comparison galaxy, with the 200-inch at Mt. Palomar.

The velocity dispersion data for M87 show a sharp increase in passing from the outer region to the core, changing from 278 kilometers per second at the edge of the core (9.5 seconds of arc from the center) to 350 kilometers per second at 1.5 seconds of arc from the center point. No such sharp increase is evident in NGC 3379. The luminosity data show a sharp brightness "spike" in the center of M87 and excess luminosity (excess in comparison to the luminosity profile of a "normal" galaxy of this class) in the central region within 10 seconds of arc of the central point.

The velocity data inside the core of M87 can be explained by a mass concentration in the center amounting to 5 billion times the sun's mass. The luminosity data for M87, which do not fit the luminosity profile of a normal galaxy of this class, do fit a profile calculated with a black hole of 3 billion solar masses in the center and a point source of light of unspecified kind. Both groups of astronomers stress, collectively in the published papers and indi-

vidually in outside comments, that these results do not prove there is a black hole in the center of M87. Other kinds of large mass concentration could fit the data. But the black hole option is astrophysically, cosmologically and philosophically the most exciting. Since the black hole and the infalling matter surrounding it could generate a lot of radiation and could be a pump for pushing the matter that seems to be coming out in M87's optical jets and radio lobes (similar phenomena are seen in other radio galaxies and quasars), its presence would make a lot of theorists happy.

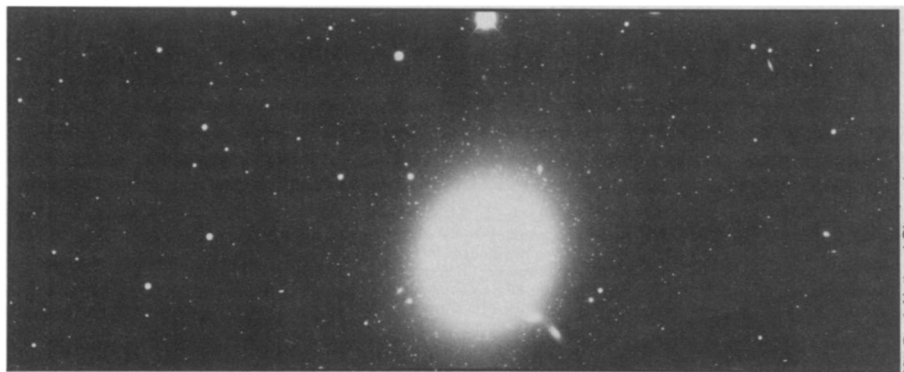
Naturally, the first question to be asked, by other astronomers as well as by the public, is whether other such examples can be looked for. They can be looked for, say these observers, but whether they will be found is a touchy question. These observations strain the capability of ground-based work. For improving the data on M87 and finding other examples, the observers recommend the Space Telescope. □

## Vitamin B6 helps autistic children

Perhaps it was inevitable that one of the most mysterious behavioral afflictions, childhood autism, should come to be treated by one of the least understood and most maligned of therapies, megavitamin therapy. The first strictly controlled studies of the effect of large doses of vitamin B6 on autistic youngsters are yielding promising results, researchers reported last week at the Academy of Orthomolecular Psychiatry symposium in Atlanta.

While the findings have obvious implications for the treatment of autism, the researchers hope they might also signal an elevation in believability and respectability for their field — one they admit is viewed by many other professionals as "hocus pocus." "This study has a great deal of significance not only in autism but in the belief held by many that the constituents of a normal diet — such as vitamins and minerals — cannot affect behavior... This is erroneous," says Bernard Rimland, director of the Institute for Child Behavior Research in San Diego.

There are already indications that the work of Rimland and others — dismissed, in effect, in a rather scathing American Psychiatric Task Force report in 1973 — may be gaining acceptance, if slowly, among psychiatrists and other professionals. The B6/autism study, for example, was published in the April 1978 *AMERICAN JOURNAL OF PSYCHIATRY* — "much to the



M87, NGC 4486, Galaxy Type EO, in Virgo: Site of black hole?