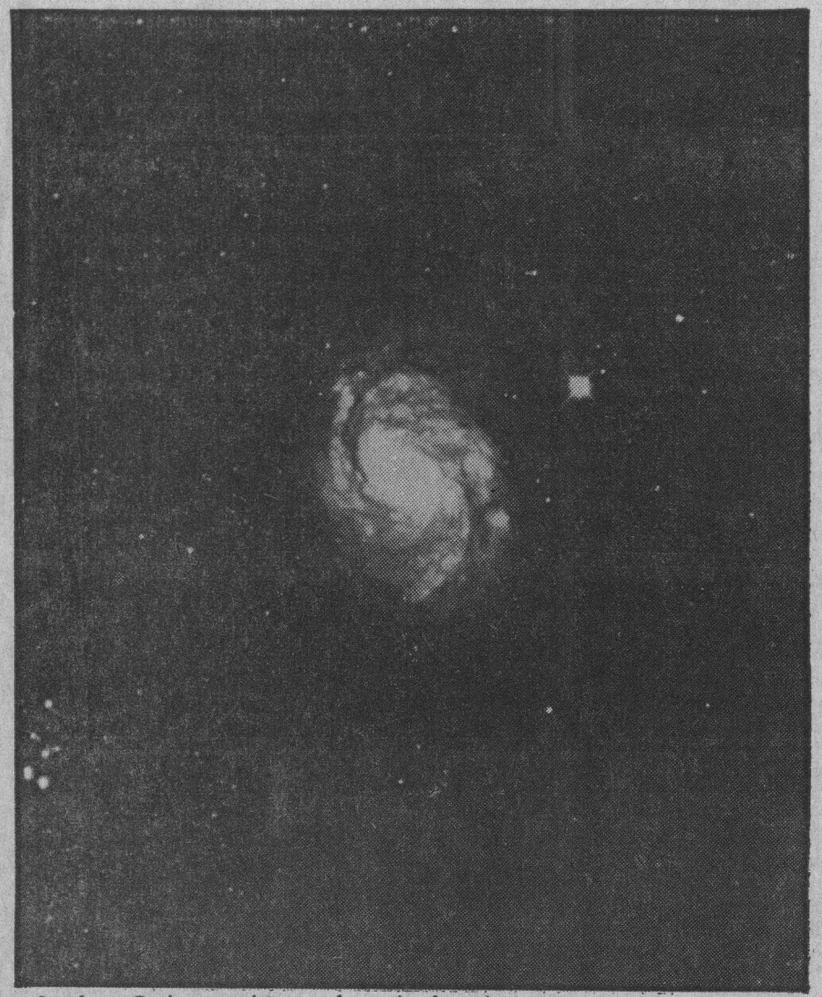
UCSC-Faculty



Seyfert Galaxy, object of study for those investigating quasars.

QUASARS/The Mysteries Persist

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In the deeps of space exist strange, enigmatic objects which have baffled astronomers since their discovery some 20 years ago. Though small, they emit enormous amounts of energy; researchers don't yet know why or how. They were formed soon after the universe's birth, and among their secrets may be the key to galactic development and evolution.

UCSC astronomer Joseph Miller has attempted for eight years to unravel the gordian knot presented by quasars, or quasi-stellar objects. He developed and built equipment, for use with the 120-inch telescope at Lick observatory on Mt. Hamilton, which discerns through polarization analysis how light was formed, and what kind of regions it passed through on its way here.

For all the work he and three graduates students at UCSC — and astronomers worldwide — have done, few definite anwers have been found. Many possibilites have been eliminated, however, and through this process of elimination, astronomers are beginning to believe that quasars are in fact those singularites in space known as black holes.

Miller joined the UCSC faculty in 1967. He was promoted to full professor's rank in 1979, and is also assistant director of Lick observatory. At his inaugural lecture at Oakes College Tuesday night, Miller spoke about his work with "Quasars, Galaxies and Black Holes."

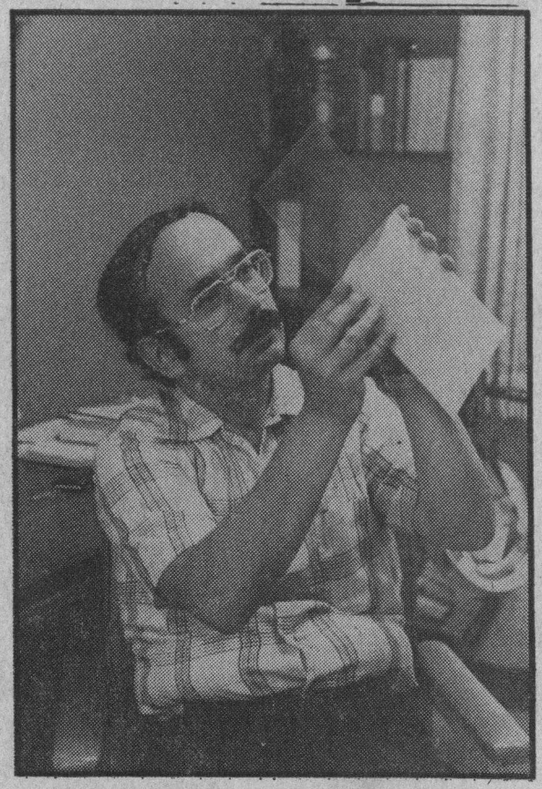
Radio waves from deep space were first detected by early radio astronomers, using technology developed during World War II. With the refined equipment of the '60s, the radio waves' sources were found to be associated with visible objects, perhaps galaxies. The radio waves and the objects' appearance gave rise to the name "quasars" — Quasi-Stellar Radio Sources.

Since then, astronomers have discovered 20 "silent" quasars for every "noisy" one emitting radio waves, and now more than 2,000 more correctly-called quasi-stellar objects are known to exist.

Miller briefly traced the history of their discovery in his lecture Tuesday, and outlined some of the problems their discovery raised which have not yet been solved.

Quasars "just a few times the size of our solar system" are more luminous than 100 galaxies. They are found in the far reaches of the universe, and most astronomers now believe their distance, and the speed at which they are receding from earth — from 6 to 90 percent of the speed of light — make them a part of an expanding universe.

Miller's own research, he said, attempted to show



Astronomer Joseph Miller at work

quasars are a part of other galaxies. The enormous distances involved — 150 billion light years — proved too great to overcome.

He believes, though still lacking hard data to back his conviction, quasars are associated with galaxies and may in fact be at their centers. Most other astronomers agree with this theory, he said.

Miller said the field of quasar study is still too primitive to explain the source of their enormous power. By the process of elimination, however, it is now inferred that at the center of quasars may be black holes. The energy of a quasar may be from stars and galactic matter being torn apart by the terrible gravitational forces of these black holes.

Black holes, currently popular devices of science fiction writers and moviemakers, are thought to result from the collapse of a star 10 to 15 times the size of our sun.

The stellar matter becomes so compressed that a black hole the size of our solar system would contain the mass of many millions of stars, according to Miller. The gravitational attraction would be so strong that nothing could escape it — even light.

Black holes are seen to be scavengers of matter, sucking into their voracious gravitational maws whole stars, or star clusters. And what goes in never comes out.

A black hole in a quasar would explain its power and size. At least, it would explain it better than any other explanation so far offered, Miller said.

Quasars are still an enigma. Though the black hole theory is attractive, lacking a better one, Miller and the rest of the astronmer community would be far more comfortable with hard data, observable proof, he said.

A telescope, to be launched by the space shuttle in 1985, may help provide that data. "I'm absolutely confident we'll be able to figure them out," Miller told the Sentinel.

He is working on another device, 15 times more sensitive than the one in use now at Mt. Hamilton, and this may also provide new data, he said.

"These are bizarre, singular objects that shine like beacons," he said, but don't fit in with what we know about galaxies. It may well turn out they have played a crucial and dramatic part in the formation and evolution of galaxies." If black holes prove to be associated with quasars, then they may have a part in the formation and development of galaxies as well; "They might be one of the most important parts," according to Miller.

"There is some kind of activity going on in the center of our own galaxy," he said, though optical astronomers are unable to observe that center. "It may be a mini-quasar, or a black hole."

When enough data is gathered, astronomers may know whether "somehow or other, galaxies manage to coalesce, collapse into huge black holes. Quasars are probably the most powerful objects by far in our universe," he concluded, "and at the same time, they're the most mysterious."