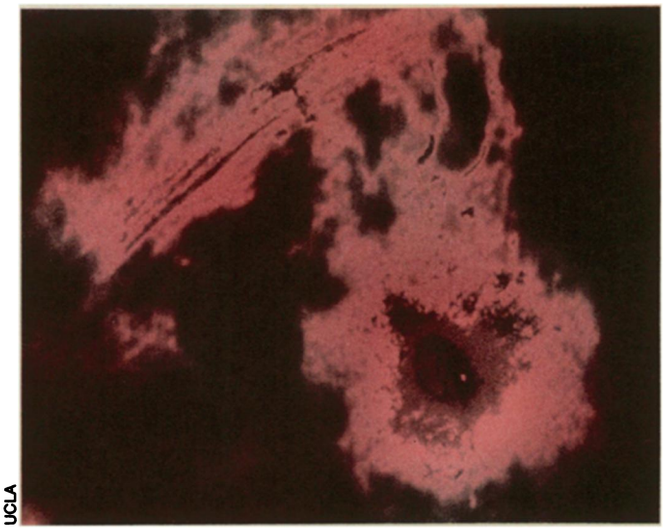
Galactic Dynamo-ism: A Radiation Belt?

What goes on in the centers of galaxies, and particularly our own Milky Way, is still very mysterious to astrophysicists. The center of our own galaxy is of course the nearest and most available for study, but shrouded as it is in dust impenetrable to visible light, astronomers have to depend on radio and infrared observations. Out of the murk have come a number of surprises. Just now a group of radio astronomers studying what they thought would be star formation in the galactic center have discovered instead a huge arc of filaments of ionized gas curving up out of the galactic disk near the center at a location about 30,000 light-years from the earth. It implies the existence of a "poloidal" galactic magnetic field.

The three astronomers, Mark Morris of the University of California at Los Angeles and Farhad Yusef-Zadeh and Don Chance of Columbia University in N.Y., used the Very Large Array radio telescopes near Soccorro, N.M., to study radio emission from near the center, which astrophysicists had assumed came mostly from processes that form new stars. They observed unexpectedly an arc of ionized gas about 150 light-years long composed of many filaments only a few light-years wide. The arc curves away from the plane of the galaxy on the galactic north side. The north-south axis of the galaxy is nearly perpendicular to (about 60° away from) the earth's north-south axis; nevertheless both north poles are on the same general side.

"The first thing you would assume," Morris says, is that this is ionized gas constrained to follow the lines of a magnetic field curving away to the north. And there is evidence for the existence of such a field in the polarization of the radiation. The arc, he says, looks rather similar to the radiation belts around the earth or Jupiter. The planetary radiation belts are held in place by the dipole fields of the planets. There is no evidence, Morris says, that the galaxy has precisely a dipole field as the earth and Jupiter do. The most he will say is that it seems "poloidal." Previous evidence for a galactic magnetic field showed only a weak field with complex directional variations. A strong poloidal field would be something quite new to galactic astrophysics.

A poloidal field implies, in analogy to the planetary fields, that an electric dynamo exists in the galaxy. The galaxy rotates, Morris points out, and the interstellar matter near the center is subject to so much ionizing radiation that it must be highly ionized and therefore an electrically conducting fluid. Those are the necessary conditions for a dynamo, so the presence of one is imaginable. There may be some similarities in other galaxies, particularly active ones and quasars. There is evidence that Morris describes as "yes and no." Some active galaxies show a good deal of vertical magnetic structure, but it may not be the same as this. Our galaxy may be the best place to study the phenomenon, he says.



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Radiograph of enormous arc of hot gas—about 150 light-years long—found unexpectedly in center of the Milky Way by astronomers from UCLA and Columbia University. Dark circular area at lower right contains highest intensity of radio emission; white dot within dark area represents exact center of galaxy. Dark, parallel lines near top are newly found filaments at the arc's core.

Activity around the center of the Milky Way is not generally symmetric with respect to north and south, Morris says. It's stronger in the north and quite weak in the south. Therefore, he doesn't expect that anything quite as strong will be found in the south. However, there could be similar arcs in the north in directions he and his collaborators did not search. Soon, he says, other groups are going to look in other directions.

The finding also seems to mean that there is less star formation in the center of the galaxy than astrophysicists had thought. They had based their estimation on the assumption that nearly all the radio flux from the center was due to star formation, but this one arc already accounts for a good deal of that flux. —*D.E. Thomsen*

Sperm power increased by relaxin

When hormones are first discovered, they are usually thought to be produced by one organ and to have one function. But as research progresses they often enter a fog in which they seem to be produced everywhere and do everything. Relaxin jumped into that mist last week when researchers announced that the hormone, originally thought to be a pregnancy facilitator unique to females, plays an important role in increasing sperm motility in males.

Augmenting sperm's ability to travel has definite practical promise, notes Gerson Weiss of New York University, who presented the findings at the 7th International Congress of Endocrinology in Quebec City. Relaxin may prove an important additive to stored sperm used in artificial insemination and in vitro fertilization and boost sperm from infertile men. In addition, it is theoretically possible to create an anti-relaxin antibody for use in contraception.

The road to relaxin's newly discovered duty was not straight. When Weiss and colleagues first looked at the effect of the hormone on sperm alone, they found "only a meager increase in motility," he says. Treatment with antibodies to relaxin made the sperm immobile, and thus encouraged tey tried a more lifelike, laboratory setup — sperm in cervical mucus, a barrier the germ cells must cross to get to the egg. "The addition of relaxin increased the penetration of sperm into both human and bovine cervical mucus," says Weiss.

The concentration of the hormone is 10 to 100 times higher in seminal plasma than in blood serum from pregnant women, the only previously known human source, thus facilitating further work on the hormone. "Sperm is a renewable resource," says Weiss. And Genentech in South San Francisco is trying to produce relaxin via recombinant DNA technology.

Relaxin is not a *sine qua non* in sperm activation, notes Weiss. "There is an entire symphony of factors," he says. "But I think relaxin is definitely a member of the orchestra. It may not be the cymbals, but it's there." —*J. Silberner*