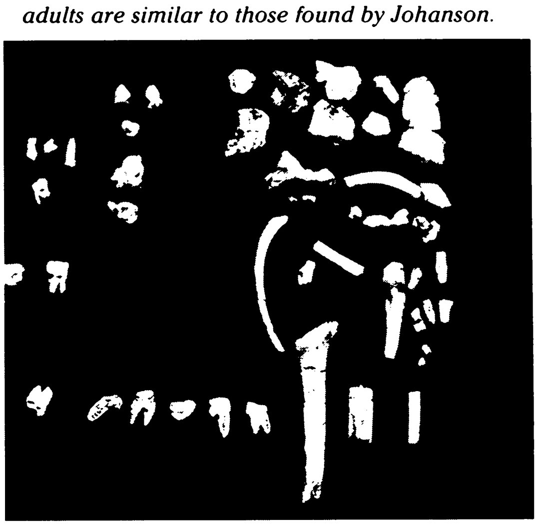
Path followed by man's direct ancestors.

contention that the brain was too small to master [moderately developed] tools."

At least for now, however, Leakey stops short of naming the creatures who left those ancient tracks. "They were direct ancestors to man," she says. But, she adds it is "doubtful" they represented pure *Homo,* although they displayed "a lot of human characteristics." On the other hand, the individual was "not like other *Australopithecus* ... which died out." Johanson and White "have made *Australopithecus afarensis* ancestral to *Australopithecus africanus* [The South African ape], which doesn't seem to be possible," says Leakey.

"We'll leave it [the naming of the species] open until we have more material," she says. "It's a very knotty problem." □

adults are similar to those found by Johanson.



The hole in the middle of the Milky Way

In the summer of 1978 evidence was reported that indicates the existence of an extremely massive object in the center of the galaxy M87. It is suspected that this may be a gigantic black hole, millions of times as massive as the sun. M87 is a very active galaxy. It is the scene of highly energetic processes that manifest themselves in a copious output of radiation of all kinds. Accepting the proposition that there is a black hole in M87 — and most astronomers are probably reserving judgment at the moment — one must ask whether such massive black holes are characteristic of active galaxies particularly or of all galaxies including quiescent ones like our own.

In a report soon to be published in the ASTROPHYSICAL JOURNAL Luis F. Rodriguez and Eric J. Chaisson of the Harvard Smithsonian Center for Astrophysics present evidence that there may be a massive black hole in the center of our galaxy. The evidence on M87 came from studies of the optical brightness of the center and of the collective motion of stars near the center. Rodriguez and Chaisson derive their evidence from a study of the radio brightness and motion of the ionized gas at the center, the radio source Sagittarius A West, done with the Haystack radio telescope in Westford, Mass.

The results indicate that the source has a core-and-halo structure. Studies of the line broadening — that is, of the Doppler shifts in the emission of certain resonant frequencies by the gas that result from motion of the gas—indicate that the gas is going around in orbit. The dynamics of Sagittarius A West, say Rodriguez and Chaisson, can be attributed to Keplerian (that is, quasi-planetary) rotation induced by the gravitational field of the stellar population to be expected at the galactic center plus an extremely compact mass equal to five million times the sun's mass. Whether this is a black hole remains to be observed. □

Fusion: Light-ion excitement

Implosion fusion is the name given to experiments that aim to produce nuclear fusion by crushing a pellet of the appropriate fuel, deuterium or deuterium and tritium. The implosion is caused by suddenly delivering energy to the surface of the pellet. The energy causes an explosive ablation of the surface layer, and the back reaction from the ablation implodes the core of the pellet.

To deliver the triggering energy physicists first thought of light, concentrated, coherent, powerful beams of laser light. Laser fusion is being pursued rather heavily in the United States and in a number of other countries. Concentrated high-energy beams of other things can also do the job: electrons, light ions, even heavy ions. Electron beams have been experimented with to a somewhat lesser extent than laser beams, but the ions were generally considered a long shot. The difficulty of making beams of ions, accelerating them and delivering them to the target made them seem less attractive.

Now, as a result of experimental developments of the last two years, there is intense interest in the use of ion beams as energy deliverers in implosion fusion. At the recent 1979 Particle Accelerator Conference in San Francisco physicists and accelerator technologists crowded a ballroom of the Palace Hotel to hear Gerold Yonas of the Sandia Corp. in Albuquerque tell the reasons why. They are two: First and foremost, it has proven easier to make and energize beams of light ions than people expected. That is not as trivial as it sounds. In this field, experiment and technology have little detailed theory to go by, and testing reasonable expectations is a laborious process. Second, if the ion beams can be made and brought to the target, they deliver energy much more easily than light or electrons.

And if it weren't for a rather fortunate circumstance, ion beam production might not be easier. Ion beams are made in diodes. These are much larger than the diodes in an old fashioned radio, and their electrodes are shaped and arranged for this purpose rather than for those of the radio. When you apply an accelerating voltage between the electrodes of the diode, what you are likely to get, says Yonas, is electrons. They are light and come off the cathode easily. Even if the electric field is made strong enough to pull atomic nuclei, that is, ions, out, there will still be a lot of electrons in the way.

The solution is to apply a pulsed magnetic field across the gap. This makes the electrons go into orbit, and the cathode is effectively surrounded by an ionized gas source with an orbiting cloud of electrons. The combination of forces provided by all this makes it convenient for the ions to come out, in currents up to millions of amperes.

The experimenters at Sandia have been working this out in an apparatus called PROTO II. The great excitement is grounded in their belief that the method will scale up. Since 1977 they have been building an apparatus called EBFA I. The building was completed late last year, and now the equipment to go into it is arriving. In a few years they expect to have 36 separate modules working together to produce 30 terawatts of power.

Once the ion beam arrives at the fusion target, it has advantages over the other