



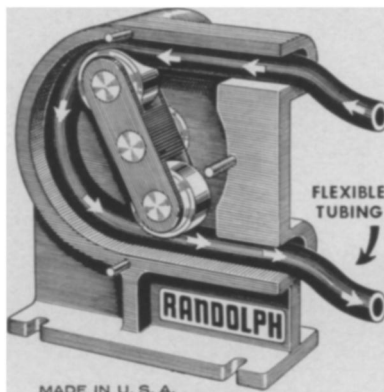
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COSMOLOGY

Matter in curved space

Since Einstein's relativity theory proclaimed that space is curved, it has become widely accepted among those who study the subject that the universe is curved. But whether it curves enough to loop back upon itself is not known.

According to Einstein, it is mass that makes space curve. The more mass, the more curvature.

But cosmologists have computed that in order to curve enough to close the universe, there must be a minimum critical density of mass. And counting all the mass they have been able to measure, that density is only about a tenth of the critical value in the stars and galaxies within reach. Some 90 percent is missing.

The remaining possibility was that there is a significant amount of matter in the vast reaches of space between galaxies. But none had been detected.

The first direct evidence that such matter exists, in the form of extremely dilute hydrogen gas, has now been obtained from a rocket-borne experiment.

If confirmed—and only two measurements have been made so far—the finding would mean a closed universe.

That would mean that the now-expanding galaxies are gradually slowing down in their outward rush. Eventually—in some 70 billion years—all the matter in the universe will have fallen back again into one great fireball of matter and radiation.

Relativity itself is not really involved in the controversy, since curved space could exist in either a closed or an open universe. In the latter, space would be curved, but would still be open, somewhat like the curves on a saddle.

The evidence for a high amount of intergalactic matter was obtained during an Aerobee rocket flight from White Sands, N. Mex., last September by scientists at the Naval Research Laboratory. Instruments on board measured the cosmic X-ray background glow in two wavelength bands—very soft X-rays and medium hard X-rays.

The two measurements indicate that the X-rays are emitted by a thin but very hot—800,000 degrees C.—plasma in intergalactic space.

The report on the possible discovery of the missing intergalactic matter was made by Dr. Richard C. Henry at the dedication of the Naval Research Laboratory's E. O. Hulburt Center for Space Research. Dr. Henry is a National Science Foundation associate at NRL.

The new center is headed by Dr. Herbert Friedman, a co-author of the report with Gilbert Fritz, John Meekins and E. T. Byram.

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