Evidence Suggests a Rotating Universe

Rotary motions are quite common in the universe. Planets rotate; stars rotate; galaxies rotate. Furthermore, all of these classes of objects revolve around others of their own kind, often in complicated group patterns. There are thus wheels within wheels: The same object may be caught up in several rotary motions of widely varying size. The biggest wheel of all, containing all the others, is the universe itself. In the July 29 NATURE P. Birch of the University of Manchester's Nuffield Radio Astronomy Laboratory at Jodrell Bank, England, suggests that the universe may rotate as a whole.

This seems to be the first time evidence is alleged for such a rotation. If it exists, it would have to be present since the beginning. Its presence would certainly change the mechanical and geometric parameters that go into theories of cosmological development. One of the most difficult things in cosmology is explaining how the lesser rotations got started. (In an expanding universe, the expansion gives linear motions directly, but figuring ways to convert linear motions to rotations takes a good deal of contriving.) A rotation built in at the start could make it easier to get lesser rotations, but at the cost of removing the question "how" to a more transcendent arena and possibly of raising the philosophical question "why."

Birch studied the orientations of 94 radio sources scattered all over the sky. These sources generally have elongated shapes, and so by mapping them an observer can determine an "axis of elongation" for each one. By studying the polarization of the radio waves the sources emit, observers can determine the direction of the magnetic field (if any) in each of them. Birch studied the differences between these two directions for each source as measured from a common reference direction.

He finds that this difference is generally negative for sources lying in one half of the sky, generally positive for sources in the other half of the sky. That is to say that to go from the elongation axis to the magnetic field direction involves a right-handed rotation in one half of the sky and a left-handed one in the other half. The line of division runs along the meridians defined by right ascensions 9 hours 15 minutes and 21 hours 15 minutes.

Normally one would expect a random distribution. Birch's statistical analysis yields a probability of only one quarter of a percent that the nonrandomness arises by chance. However, it could arise from a "systematic error" caused by the method of measuring the polarizations. To test this, Birch studied a sample of very bright radio sources, in which the magnetic field direction can be determined by other means. He finds the same asymmetry, and so concludes that the effect has something to do with the universe.

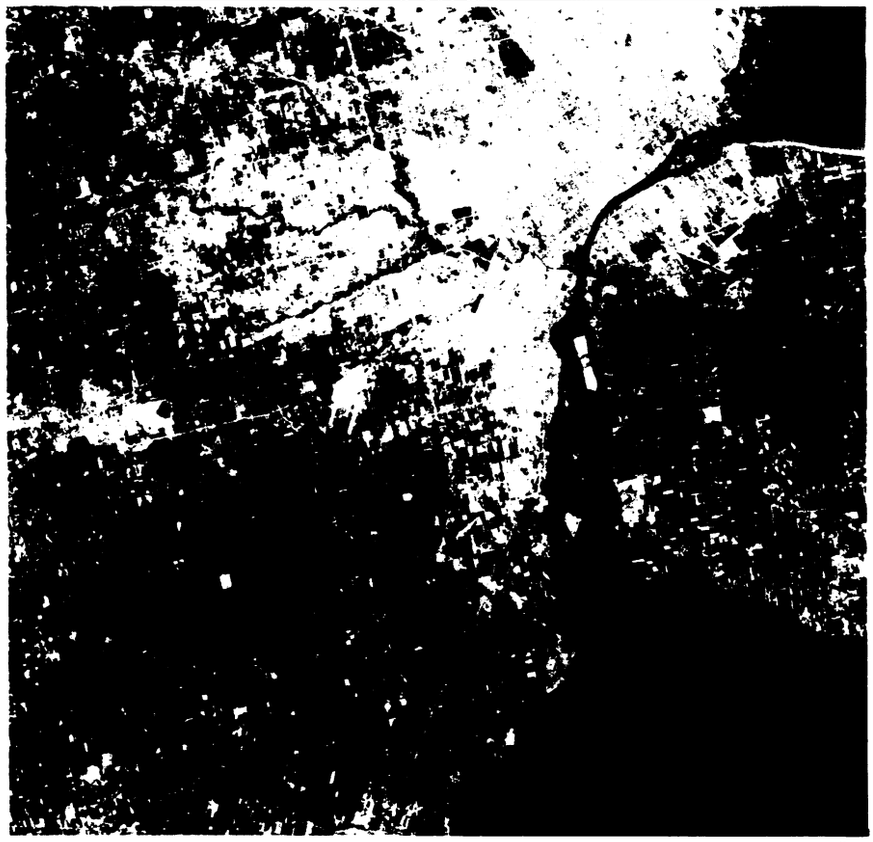
Two plausible causes for such a nonrandom distribution of orientations suggest themselves: an over-all universal magnetic field that is lining up the radio sources, or as Birch suggests, a rotation of the universe as a whole, with the radio sources lining up with a vorticity generated by the rotation.

Other kinds of studies of the magnetic properties of extragalactic radio sources (of the so-called Faraday rotation) indicate that any universal magnetic field must be too weak to have a direct effect on the orientation of the fields in the radio sources.

This leaves a universal rotation, and Birch opts for it: "An alternative and attractive explanation is that the radio sources rotate relative to the intergalactic medium, the axis of rotation being preferentially aligned with a universal vorticity." That vorticity would be provided by a universal rotation that is hardly dizzying; it amounts to about 10^{-13} radians per year. (A radian is $1/2\pi$ of a full circle or 57.32°.)

Attempts to find a rotation effect by studying orientations of spiral galaxies have so far not shown anything conclusive. Another way to look is to study the differences in the temperature of the microwave cosmic background radiation in different directions. Some small variations have been found, and their smallness places an upper limit on the possible amount of universal rotation. George F. Smoot of the Lawrence Berkeley Laboratory in Berkeley, Calif., who has done extensive work on variations in the microwave background, comments that Birch's value for the rotation is consistent with the limit set by the microwave background. —*D. E. Thomsen*

Landsat 4's new eye on the earth



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A portion of the first image produced from the Landsat 4 satellite's "thematic mapper" (TM) (SN: 7/3/82, p. 4) shows the Detroit, Mich./Windsor, Ontario area, revealing sediment turbidity in Lake St. Clair (top right) and Lake Erie. Spatial resolution is about 30 meters, considerably sharper than the 80-meter resolution of the multispectral scanners (MSS) aboard this and previous Landsats. Image is from the mapper's "green" channel; blue, red and near-infrared (plus IR and thermal IR) bands are added to produce color composites. The seven TM bands are narrower than the four of the MSS (the TM green channel, for example, spans 0.52 - 0.6 microns, versus 0.5 - 0.6 in the MSS), enabling more precise spectral discriminations for Landsat's earth-resources studies.