

Shrinking the incredible universal magnet

In the Beginning, did a magnetic field permeate the expanding universe? And if so, how did it affect the universe we see today?

Cosmologists agree that the strength of that ancient field, if it existed, determined whether magnetism helped gravity form the structures that fill the present universe — from individual galaxies to vast galactic clusters — and whether the magnetic fields of those structures derived from a primordial field.

Radio astronomer Jacques P. Vallée of the Herzberg Institute of Astrophysics in Ottawa, Ontario, has conducted the most extensive search to date for traces of a uniform, universal magnetic field. His analysis of the magnetic fields of more than 300 distant galaxies and quasars reduces by five times the lowest prior estimate of the maximum strength possible for a universal field. To the limits of current measurements, "the universe as a whole lacks magnetism," Vallée reports in the Sept. 1 *ASTROPHYSICAL JOURNAL*.

He reaches his conclusion despite recent discoveries of magnetic fields on far grander scales than ever before — spanning entire galaxy clusters — and last year's report of a magnetic "bridge" between two clusters. Vallée concedes that a universal magnetic field might yet exist, but at a strength too weak for detection by current techniques. As observers find additional cosmic magnetic fields, he says, the degree of precision for measuring a universal field will improve. But he adds that it "will take perhaps 100 years" to collect data on enough fields to reveal a universal field.

Vallée and others say the revised limit constrains theories of galaxy formation and clustering, ruling out the possibility that any existing universal field participates in the creation of new galaxies or clusters. And "it's debatable whether [such a weak universal field] could have had any effect at all [on cosmic structure] in the early universe," Vallée says.

The limit further weakens the ailing superconducting-cosmic-string theory, which requires a stronger magnetic field than Vallée's calculations allow, says astrophysicist Abraham Loeb of the Institute for Advanced Study in Princeton, N.J. That theory suffered a major blow last spring when the Cosmic Background Explorer satellite confirmed the near-perfect smoothness of the cosmic background radiation, Loeb says (*SN*: 3/24/90, p.184; 4/21/90, p.245).

Vallée's finding also affects theories of how galactic and intergalactic magnetic fields formed. It reduces the probability that they condensed out of a more vast, universal field, Loeb says, and supports the idea that they originated with locally grown "seed" fields, amplified to current strengths by galactic rotations.

Astronomers detect cosmic magnetic fields by measuring the rotation of polarized radio waves emitted from distant galaxies and quasars. This rotation, caused by intervening magnetic fields, correlates with field strength and direction. Researchers then use statistical techniques to distinguish regional influences, such as the field of our own galaxy, from the universal field.

But that approach appears flawed, contends Philipp P. Kronberg of the University of Toronto, a co-discoverer of the magnetic "bridge" between clusters.

U.S. populace deemed 'sexually illiterate'

The first large-scale survey of U.S. sexual knowledge indicates that American adults remain remarkably ignorant about contraception, venereal disease and what generally goes on behind the nation's bedroom doors. In an era increasingly fraught with teenage pregnancies and sexually transmitted diseases, including AIDS, these findings bode ill for the nation's health, says June Reinisch, chief author of the report. Reinisch directs the Kinsey Institute for Research in Sex, Gender and Reproduction in Bloomington, Ind., which conducted the survey with the Roper Organization, a national polling concern.

Numerous studies in the past five decades, including some by the Kinsey Institute, have produced attention-grabbing surveys of U.S. sexual behavior. The new study, now being prepared for publication in a scientific journal but released in book form last week, differs from previous polls by looking not at what people do but at what they know.

"It's very important to know what people know," Reinisch says, so that sex educators can design programs that specifically address the public's most glaring knowledge gaps. According to her report, some of those gaps resemble chasms. Indeed, Reinisch maintains, the poll shows that the United States is a country of "sexual illiterates," with a body politic dangerously burdened with carnal misinformation.

During October 1989, pollsters asked people aged 18 or older to answer the 18 questions most commonly asked of the Kinsey Institute by the general public. Fewer than one-fifth of the 1,974 respondents answered 12 or more questions correctly, and only four — all of them women — got 16 or more right.

Among the more striking misconceptions, about half of Americans apparently believe people can acquire AIDS from anal intercourse even if neither partner harbors the virus that causes the disease. Although that notion might lead people to err on the side of caution by avoiding

Earth-bound observers looking across vast expanses of space can only detect an average magnetic field, he says. If intergalactic magnetic fields change direction every few million light-years or so, as Kronberg suspects, their opposite twists on radio waves reaching Earth cancel each other out to some degree.

"If you were to take a probe and walk around the universe," Kronberg asserts, "you could find that the field is a good bit higher" than Vallée has calculated. Moreover, he argues that Vallée's limit depends strongly on an assumed value for the density of matter in the universe — a number, he says, that astronomers "pick out of a hat."
— *P.L. Weiss*

anal intercourse altogether, other mistaken beliefs uncovered by the survey clearly add to the risk of spreading AIDS and other sexually transmitted diseases, Reinisch says.

For example, most women underestimated the percentage of men who have had a sexual experience with another man (about one-quarter to one-third of them have, Reinisch says). This could lead women to underestimate the odds that a sexual partner carries the AIDS virus. And half of the respondents didn't know that oil-based creams and jellies such as baby oil, petroleum jelly and some hand lotions can punch microscopic holes in latex condoms and diaphragms, allowing rapid penetration of viruses and sperm.

Although the Northeast and South scored worse overall than any other parts of the nation (the Midwest consistently scored best), these regions scored the highest on AIDS-related questions. Reinisch says this hints at the success of federally sponsored AIDS-education programs, which have focused on the Northeast and South because these areas contain eight of the nation's 11 most AIDS-afflicted cities. With a U.S. teenager acquiring a new sexually transmitted disease every 13 seconds, and with a new teenage pregnancy occurring every 30 seconds, it becomes critical to broaden education programs to include more generally relevant sex-related topics, she says.

Even the elderly need to get better informed about sex, Reinisch adds, noting that they represent a growing population that can influence sex-education policies through their votes. She suggests that a lack of voter pressure contributes to Congress' continued unwillingness to fund a national survey of sexual behavior (*SN*: 7/8/89, p.28). Such a survey, Reinisch argues, would immensely aid public health officials in predicting the spread of the AIDS virus and in planning strategies against this and other sexually transmitted infections.
— *R. Weiss*