

field, thereby providing unequivocal evidence for mesoscopic quantum tunneling of the magnetization in Mn_{12} .

Regarding the physics, Gunther is quite correct in pointing out that the tunneling must be produced by a transverse field. In our work, we attributed the resonant spin tunneling at a fixed longitudinal field to an internal (dipolar and hyperfine)⁴ or external⁵ static transverse field (see also the theory given in reference 6). Gunther and others invoke a time-dependent longitudinal⁷ or transverse⁸ field to account for the experimental results. This issue will surely be resolved by further investigation.

References

1. J. R. Friedman, M. P. Sarachik, J. Tejada, J. Maciejewski, R. Ziolo, J. Appl. Phys. **79**, 6031 (1996).
2. J. R. Friedman, M. P. Sarachik, J. Tejada, R. Ziolo, Phys. Rev. Lett. **76**, 3830 (1996).
3. L. Thomas, F. Lioni, R. Ballou, D. Gatteschi, R. Sessoli, B. Barbara, Nature **383**, 145 (1996).
4. J. M. Hernandez, X. X. Zhang, F. Luis, J. Tejada, J. R. Friedman, M. P. Sarachik, J. R. Ziolo, Phys. Rev. B **55**, 5858 (1997).
5. J. R. Friedman, M. P. Sarachik, J. M. Hernandez, X. X. Zhang, J. Tejada, E. Molins, R. Ziolo, J. Appl. Phys. **81**, 3978 (1997).
6. D. A. Garanin, E. M. Chudnovsky, Phys. Rev. B **56**, 11102 (1997). J. Villain, preprint.
7. L. Gunther, Europhys. Lett. **39**, 1 (1997). V. V. Dobrovitski, A. K. Zvezdin, Europhys. Lett. **38**, 377 (1997).
8. A. L. Burin, N. V. Prokof'ev, P. C. E. Stamp, Phys. Rev. Lett. **76**, 3040 (1996).

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Do-It-Yourself Analysis Proposed for NCI's Data on Iodine-131

The September issue of PHYSICS TODAY contains a "Washington Reports" item (page 54) about the iodine-131 exposure resulting from US atmospheric nuclear tests in the 1950s and 1960s. The National Cancer Institute study tabulating this exposure received wide news coverage, so it is good that PHYSICS TODAY presents enough information and World Wide Web links to enable readers to evaluate the validity of the data.

The NCI map of county-by-county per capita doses (reproduced on page 55) presents a *prima facie* case that the study suffers from uncontrolled systematic errors. One can clearly see the state boundaries, with those

between North Dakota and Minnesota, and between Idaho and Oregon, being particularly noticeable.

I surmised that the unusual geographical behavior of the data might have resulted from differing economic practices across state lines (for example, the number of dairy farms), so I looked at figure TS-1 of the NCI technical summary (<http://rex.nci.nih.gov/massmedia/techsum2figts1.html>) showing "activities of I-131 deposited per unit area of ground." These data should not be sensitive to political boundaries, but, in fact, the Idaho-Oregon border shows up even more distinctly than in the dose map.

I am not trying to excuse the unconscionable behavior of the US government during its nuclear testing program. However, some of the specific conclusions of the NCI report, such as the identity of the five counties (all in Idaho and Montana) receiving the highest per capita doses, are suspect. Singling out these counties alarms some people unnecessarily and comforts other people falsely.

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Book Review Fuels Debate on History of NMR Imaging

As the writer of *The Pioneers of NMR and Magnetic Resonance in Medicine: The Story of MRI* (co-authored with the late Merrill Simon), I appreciate Paul Moran's statement in his PHYSICS TODAY review (January, page 66) that "This book is a 'must read' volume for all serious students of NMR in chemistry, physics or bioscience for its early NMR biographies." However, I take strong exception to several of his criticisms.

First, as to Moran's complaint about which pioneers received individual chapters and our alleged slighting of Peter Mansfield, if we had cut the list off at ten instead of nine, Mansfield would have been number 10 overall, number 3 for MRI alone. Even so, his important contributions are pointed out repeatedly in the book.

Second, I was perplexed by Moran's statement that "Mansfield and his colleagues' roles are attenuated by their portrayal as quaint, tea-sipping Upper Midlands academic onlookers—at least some comic relief to those who know the old Nottingham gang." Just in case I had subconsciously used such an inappropriate characterization, I searched the text for

"tea," "quaint," "Upper Midlands" and "onlookers." I found no such depiction—direct or indirect. The portrayal is Moran's.

Third, Moran's conclusions about the Damadian-Lauterbur-Mansfield controversy are also without merit. For example, although Paul Lauterbur failed in his 1973 article on zeugmatography¹ to cite Raymond Damadian's March 1971 article about NMR's usefulness in detecting tumors,² he did cite Damadian's article in his own lab notes (September 1971), in which he first recorded his idea for spatially localizing Damadian's relaxation information. I consider those countersigned notes an important clue as to what led to what in MRI.

I was surprised by Moran's statement that the T1 results reported by Damadian "were seminal for oncology and widely cited for some time, but unfortunately, they did not apply to human cancers." What then are those dark spots on T1 MRI images of humans afflicted with cancer (shown as white spots on the corresponding T2 images)? Incidentally, Damadian's 1970 findings, reported in 1971, dealt with both T1 and T2 relaxation and with both healthy and cancerous tissues.

I also take issue with Moran's statement, "Nor is there any evidence presented that Damadian had the slightest clue about how to actually build an NMR scanner until well after at least a dozen other labs were installing MRI units based on the Lauterbur-Mansfield-Ernst gradient modulation methods." Here, Moran is ignoring the book's lengthy description of Damadian's not-so-clueless building of "Indomitable" (even Mansfield collaborator Peter Morris credits Damadian's work as a "truly remarkable feat"³). Moran also overlooks the very important point that the medical NMR efforts of those other labs were precipitated by Damadian's T1 and T2 findings, and he completely misses the point, made repeatedly in the book, that Damadian did not use the gradient method to achieve the world's first whole-body MRI scan (1977), nor did Damadian use the gradient method in the world's first commercial MRI scanner (1980). Rather, he used successfully the point-by-point method proposed in his 1972 patent application.

One of the important features of the book is its exhaustive referencing. On that basis alone, the diligent soul who wants to search for the truth can do so. I believe a careful prospector will arrive at the same conclusions presented here and in the book.