the signature is so unique that the transition can be detected directly. Another is in the measurement[1] of the small electromagnetic interaction of the neutral kaon with the electron. In that experiment, A was the much larger strong interaction of the kaon with the nucleus, which could be made to interfere with B, the K–e interaction. The experiment consisted of measuring $|A+B|^2$ and $|A|^2$ separately and thereby isolating an effect. This technique involves taking the difference of large numbers, where one has to pay very close attention to systematic uncertainty. It is possible that using the same amount of beam to detect the K–e interaction directly (with an energetic electron emerging from the target) would have produced a more significant result.

Reference

1. W. Molzon *et al.*, Phys. Rev. Lett. **41**, 1213 (1978).

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Henry Torrey's Signal Nmr Achievement

Frederick Seitz's excellent article on World War II research on silicon and germanium semiconductors and transistor devices (January, page 22) describes Henry C. Torrey's leadership of the crystal diode work at the MIT Radiation Laboratory. It was not mentioned and is in general not well known in the physics community that Torrey also found time in 1945 to pioneer in another research direction that opened the door to a major new field of 20th-century physics, namely nuclear magnetic resonance.

In earlier work at Columbia University under I. I. Rabi, Torrey gained the background that later, at MIT, gave him unique insight into the physics of spin systems and led to improved estimates of spin–lattice relaxation time and of the rf voltage level needed to avoid saturation. This expertise made possible the design of the first successful experiment on nmr in solids, in 1945,[1] after previous workers had failed.[2] Torrey's collaborators in the experimental implementation of nmr were his MIT coworkers Edward M. Purcell and Robert V. Pound, who became well known for their later nmr research with Nicolaas Bloembergen on solids and liquids, carried out at Harvard University. The experimental skill of the MIT group, perhaps sharpened by their Rad Lab experience, is attested to by their inspired combination of an off-the-shelf oscillator, electromagnet and voltage amplifier, which produced an observable proton nmr signal with a paraffin sample on the first attempt, within the experimental parameters estimated by Torrey.

It is somewhat surprising that in 1995, the 50th anniversary of the discovery of nmr, this historic first has not received wider recognition and some form of commemoration. The detailed story of this episode, including the roots at Columbia University, the flowering at MIT and the various contributions of the participants, remains an inadequately reported chapter in the history of physics.

References

1. E. M. Purcell, H. C. Torrey, R. V. Pound, Phys. Rev. **69**, 37 (1946).
2. C. J. Gorter, L. J. F. Broer, Physica **9**, 591 (1942).

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Open NSF's Purse to Those Outside Academe

I wholeheartedly agree with Henry Ehrenreich in "Strategic Curiosity: Semiconductor Physics in the 1950s" (January, page 28) that it is important to protect the position of "generic," "curiosity-driven" or "basic" research within the National Science Foundation. Surely there are other agencies, such as the National Institute of Standards and Technology, that are better suited to playing the lead role in "strategic" research. That is not to say, however, that changes at NSF should not be made in light of changing conditions within the physics profession. Specifically, I have in mind the traditional rule that the NSF-sponsored single-investigator proposal, a key component of basic research, is usually limited to researchers within the university community.

In the current situation, graduating physicists who go on to careers in government, industry, nonprofit institutions, contract research and development centers and self-employment are excluded from principal-investigator status in a broad range of NSF programs directed toward basic research. This would be a majority of graduating and recently graduated PhDs. I suggest that as it is improper to deny participation based on gender or race, so too is it inappropriate to deny participation based on institutional affiliation. This nation needs to take advantage of the possible contributions of *all* physicists in this increasingly competitive world, especially in an era of ever tightening Federal budgets, when it is imperative to make the fullest use of available expertise.

There seems to be general agreement that we are producing more PhDs than there are traditional academic jobs at universities. This is not necessarily a bad thing, and some people have noted that physics training provides a rigorous background suited to a whole host of careers. If leaders within the physics community itself would set the good example of attempting to open up NSF research funding to all qualified physicists, regardless of institutional affiliation, this would provide a powerful example of the usefulness of physics training beyond traditional university research. Also, by looking more at the researcher than at his or her place of employment, I believe we would be taking a necessary step in increasing the stature of the physicist as an independent professional. Such a stature would serve well in enabling physicists to thrive outside traditional roles.

As it may be artificial to distinguish between strategic and curiosity-driven research, so too might it be artificial if not out of date to distinguish between university-based and otherwise-based researchers. And it might be wrong, too, if the purpose of Federal support for basic research is the advancement of the best possible physics.

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Can Coal Combustion Breed Pu in the Sky?

The conventional wisdom regarding plutonium in the environment is that its halflife of 24 400 years is sufficiently short that no natural-source plutonium remains in the biosphere, and any plutonium in the biosphere must have originated from breeding plutonium in uranium for nuclear weapons and reactors. This "wisdom" may be flawed, however, and we must ask if plutonium is being bred in the biosphere by natural, but unidentified, means.

The mechanism for breeding plutonium is well known: A uranium-238 nucleus plus one neutron becomes plutonium-239 after passing through some intermediate steps. Trace element analysis of coal shows significant quantities of uranium and thorium. For example, Environmental Protection Agency analysis[1] of 5000 samples of coal from varied sources gives an average uranium concentra-