do everything immediately. I agree with George Keyworth's position that lower-priority research areas must give way to provide the means to give emphasis to more promising areas of research.

The condensed-matter community should take heart in the fact that it is being provided new and expensive research facilities to attack selected areas of research. The community has disagreements over which one comes next and still worse, refuses to face the question which of the existing stable should be shut down. Because of the void that the community constitutionally is incapable of healing, decisions are made by government, a political arena.

My remarks were made to the NAS/NRC Solid State Sciences Committee (not the Lynch subcommittee) in an effort once again to motivate a closing of the ranks to elicit recommendations of priorities of the condensed-matter community as input to the governmental decision-making process.

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Nuclear-waste disposal

I wish to call attention to one point concerning the nuclear-waste-disposal debate that is frequently overlooked in such dialogs (December, page 36). The point of concern is the effect of radiation damage on the integrity of the geological disposal site, particularly for salt-dome or bed disposal. One effect that was obvious from the Lyons, Kansas, test of 1972 was that the physical properties of the salt had changed. The salt next to the cannisters developed a deep blue-black color under irradiation and became very brittle. The coloration changes were due to the formation of colloidal sodium particles in the salt.

Subsequent research at Harwell,[1] Brookhaven[2,3] and elsewhere characterized the growth of colloidal sodium particles in natural rock salt and synthetic NaCl. The growth of sodium metal from the natural rock salt follows a Ct^n dependence where C is a constant, t is the irradiation time (constant dose rate assumed) and n is expected from theory[4] to be in the range 1–2. Recent experiments[3] on samples from various localities measured $n = 1.85 \pm 0.18$. The growth of the colloid is temperature dependent and reaches a maximum in the vicinity of 150 °C. The data, when extrapolated to a dose reasonable for a repository [10^{10} rad(NaCl)], indicate that the salt will contain 0.01 to 10 mole percent sodium metal, and perhaps be completely dissociated by 10^{11} rad. Impurities, brine, and strain in the salt are some of the factors that govern the actual rate of colloid production.[3]

While the implications of these findings are not known at present, they raise considerable questions about the suitability of a rock-salt formation as a permanent waste-disposal site due to the instability of the formation in a high-dose radiation environment.

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The debate on radioactive-waste disposal seemed incomplete because it failed to mention the nuclear-waste implications of underground nuclear weapons tests—both as a source of data and as a prototype method for disposal.

Hundreds of underground nuclear explosions have been set off by the US and the Soviet Union over the last twenty years, and France has recently moved its South Pacific tests underground. The amount of radioactivity released per explosion is smaller than the radioactive waste from a nuclear power plant, but it is not negligible. The one kilogram of fission products produced by a "nominal" twenty-kiloton test equals the amount created in 10 hours of running time of a 2.3 Gigawatt (thermal) nuclear power plant. The residue of each test contains approximately 1–10 kilograms of uranium and/or plutonium. These wastes are intimately mixed with the rock which is vaporized by the heat of the explosion. The mixture cools and solidifies in place.

By drilling back into the residue from old nuclear tests, one can recover radioactive core samples that provide experimental data concerning the stability of the solidified formation. Different rocks can be compared, because nuclear tests have been done in Alaska, Colorado, New Mexico and Mississippi, as well as at the Nevada test site.

If a stable geologic formation can be found and approved, nuclear explosives may be the least expensive method of dispersing the wastes into the rock. If each 20-kiloton nuclear explosive were surrounded by spent fuel rods containing 10 or more kilograms of fission

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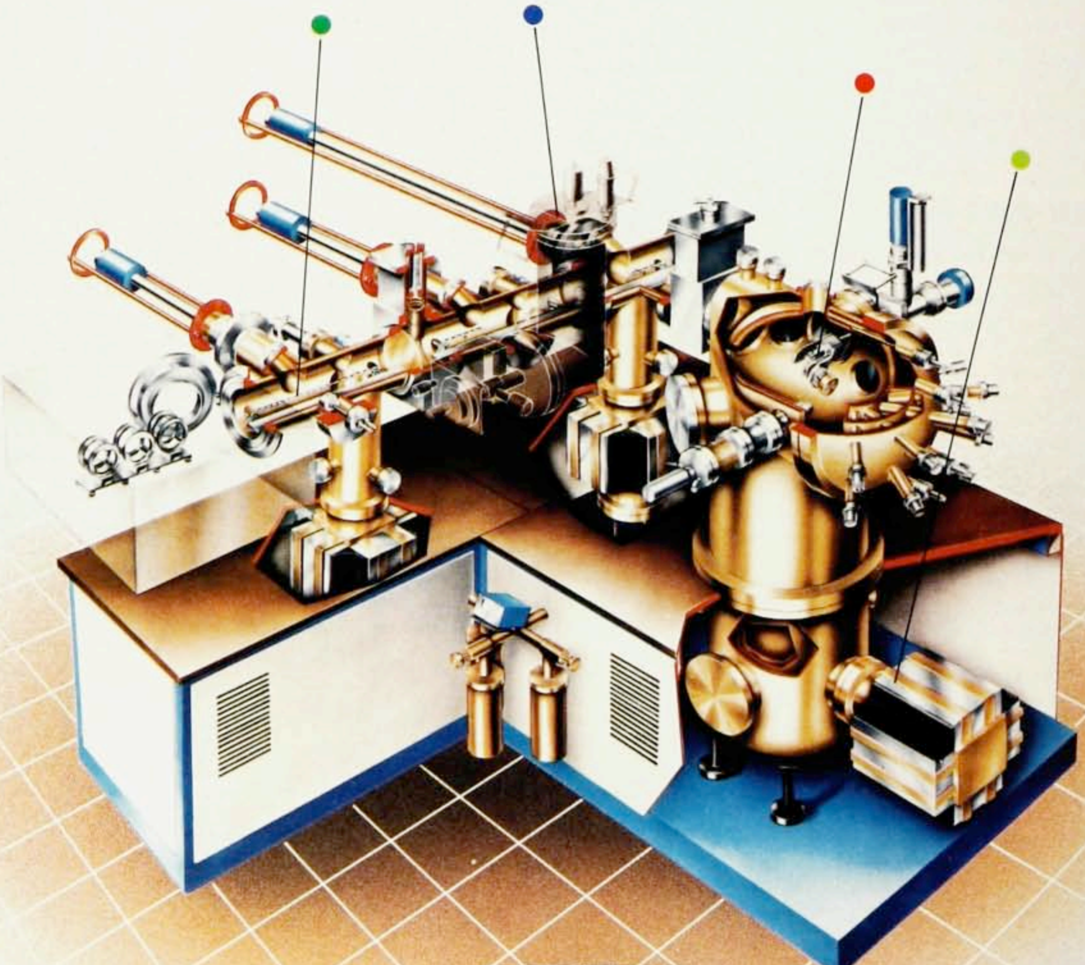

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products, then the one kilogram of radioactive wastes added by the explosion would be a small amount by comparison. No expensive processing of the rods is needed—just transportation to the bottom of the hole. If the residual uranium and plutonium should become valuable in later millenia, they could be mined at that time. In short, the nuclear explosive test sites can be viewed as existing waste disposal areas. Isn't it conceivable that they could be expanded to include nuclear-reactor wastes as well as nuclear-test residues?

JAMES W. SHEARER
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1/83

THE AUTHOR REPLIES: James Loman points to an interesting technical issue concerning the effects of ionizing radiation on rock salt. For the protection of the rock salt it may be necessary to use an overpack around the waste canisters that absorbs the radiation without undesirable physical or chemical side effects.

To use nuclear explosives for the emplacement of high-level nuclear wastes in a geologic formation, as suggested by Shearer, appears to me somewhat like fighting fire with fire. I would be particularly concerned about the effect such explosions would have on the long-term integrity of the geologic formation. This disposal concept belongs to the class of alternative disposal options referred to as "rock melt concepts"; to date they have received only limited attention.[1] In the Final Environmental Impact Statement on the Management of Commercially Generated Radioactive Waste (DOE/EIS-0046 F, October 1980), their major problems are summarized as follows: "Primary needs would be for better understanding of heat-transfer and phase-change phenomena in rock to establish the stability of the molten matrix and for development of engineering methods for emplacement" (chapter 6, page 28).

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ROBERT O. POHL
Cornell University
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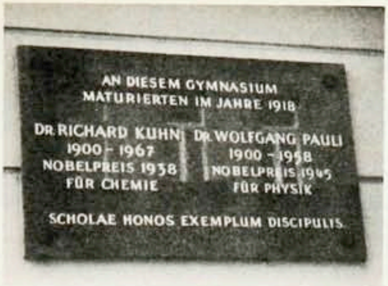
2/83

Another class with two Nobels

A recent news story (February, page 53) posed the question of whether a clustering of later prominent scientists occurs in certain high-school classes. I enclose a photo of a plaque on my old high school, the "gymnasium" in the 19th



district of Vienna, Austria, which commemorates the two Nobel prize winners who graduated in 1918, in a class of 27 students. They were Wolfgang Pauli (physics, 1945) and Richard Kuhn (chemistry, 1938). It must, of course, be remembered that a gymnasium is a college preparatory school, not strictly comparable to a high school in the US.

JOHN F. KRASNY
Kensington, Maryland
2/83

Bronx High School of Science

I read your news story in February (page 53) concerning the 1950 class of Bronx High School of Science with some interest since I am a 1954 graduate of that school. As you can see, my name is missing from the list of physicists who graduated in the years 1940–60, and this leads me to suspect that others also may have been missed. Perhaps PHYSICS TODAY could render Gerald Feinberg a service by issuing a call to readers who are Bronx Science graduates to identify themselves. I hope that Feinberg writes his book, and I look forward to reading it.

EDWARD GELERINTER
Kent State University
Kent, Ohio
2/83

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I really enjoyed your article about Bronx Science. However, I think that you only got the tip of the iceberg. I graduated in the Class of 1955. You listed two physicists from that class, myself and Norm Gelfand, but I know of five others: Michael Arons (CCNY), Bob Einstein (University of Illinois), Tom Ferbel (University of Rochester), Ed Ginsberg (University of Massachusetts, Boston), Robin Motz (PhD in physics from Columbia, formerly on the faculty of Stevens Institute of Technology and an associate editor of the American Journal of Physics. Now an MD and on the faculty of Columbia College of Physiciana and Surgeons).

Tom Ferbel tells me that Don Landman of Hawaii and Claude Penchina of Univeristy of Massachusetts, Amherst, are also from our class.

MICHAEL J. TANNENBAUM
Brookhaven National Laboratory
Upton, New York
2/83

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