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## Superconducting accelerator booster

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Heavy ion accelerators are the thing that everybody experimenting in nuclear physics would like to have. Accelerating one atomic nucleus to high energy and hitting it against another is a technique that has exposed surprisingly different behavior on the part of nuclear matter. Everyone who already has a heavy-ion accelerator would like to increase its energy.

There is now an affordable technique by which they can, according to a group of scientists at the Cryogenics Laboratory of the California Institute of Technology that includes James Mercereau, Jean Delayen and John Dick. They have designed a superconducting resonator for heavy ions that can be made to act as an energy booster for existing accelerators.

A resonator receives moving particles and hits them with a burst of radio waves timed in synchrony with the particles' motion. The particles are then accelerated by the waves. In recent years there have been a number of projects to apply superconductivity to this aspect of accelerator technology. The chilling of certain metals to temperatures near absolute zero brings about a loss in resistance to direct electric current and an almost total reduction of resistance to alternating currents. Its use in accelerator resonators would give much more energy to the particles at

much less expense of energy in the device.

Projects to apply superconductivity to accelerator resonators for electrons and for protons have been worked on as well as those for heavy ions. The one for heavy ions was developed first, according to Dick, because ions at an energy of 10 million electron-volts move at a small fraction of the speed of light (.03 to .05). This makes it less difficult to design a resonator to resonate with them than it does to design one for electrons, which at that energy are nearly at the speed of light. There is also a project for heavy-ion resonators at Argonne National Laboratory, but that, says Dick, is oriented toward national laboratories. "Our booster is an inexpensive one that universities can afford." An accelerator could also be built from scratch with these modules.

The first application of it will be at the State University of New York at Stony Brook, where 11 of the booster modules will be installed in the existing linear accelerator under the direction of John Noe. This is expected to boost the accelerator's energy from 10 million electron-volts to 25 million at a seventh the cost of building a 25-million-volt machine from scratch. In addition it will run cheaper. A superconducting booster unit draws about 300 watts of rf power compared to a conventional booster's million watts. In addition, there is some power expended on the refrigerators that maintain liquid helium temperature, but, says Dick, you still come out far ahead.

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## Parental death and schizophrenia

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If, as has been suggested, the line between genius and psychosis is a narrow one, then it should not be too surprising that both types of persons may have common elements in their family backgrounds. According to some researchers, one such possible factor is early loss of a parent. Recent reports have linked parental loss with genius (SN: 4/22/78, p. 245) and with psychotherapy-seekers (SN: 1/14/78, p. 21).

Now, three studies published in the July AMERICAN JOURNAL OF ORTHOPSYCHIATRY suggest a possible link between early parental loss and schizophrenia. Researchers Norman F. Watt of the University of Denver and Armand Nicholi Jr. of Harvard Medical School acknowledge that their work comes against a historical backdrop of conflicting study results in this area. But in each of their studies they report that, at least statistically, "premature death of a parent may be a contributing factor in the etiology of schizophrenia."

Moreover, Watt and Nicholi found that the high frequency of parental death among schizophrenics is "not attributable to a genetically-linked tendency toward suicide in parents." In addition, parental death appears to occur earlier in the lives

of schizophrenics than in those of other patients studied, and, in two of the reported studies, was most frequent among schizophrenics with predominantly paranoid symptoms.

The researchers studied a total of 1,139 patients, including 185 diagnosed as schizophrenics, from the records of the Massachusetts Department of Mental Health, Harvard University ("psychiatric dropouts") and the Göttingen (Germany) University Psychiatric Clinic. In the combined populations of the three studies, they found an overall parental loss rate among schizophrenics of 23.8 percent, compared with a 14.4 percent rate among all patients and about 10 percent among random nonpatient controls in two of the studies.

They warn, however, that "death of a parent is but a single event whose implications for psychological development are complex and contingent upon many factors, such as surrogate parents, subsequent family situation, economic hardship, possible institutionalization and general social integration. Parental death should be considered a serious pathogenic life stress," say Watt and Nicholi, "but not a necessary or an irreversible cause of schizophrenia." □

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## Energy from heat via chemistry

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Fuel generation directly from heat, without electricity as an intermediary, has promise as an efficient energy strategy. Scientists at the Oak Ridge National Laboratory now report a cycle of chemical reactions that can split either carbon dioxide into carbon monoxide or water into hydrogen and oxygen. Hydrogen and carbon monoxide, separately or reacted together, are valuable not only as fuels, but also for energy storage and as raw material for synthesizing other fuels.

The reaction cycle developed by Carlos E. Bamberger and Paul R. Robinson has no waste material. The products of one reaction become the raw material for the next. In the three steps, first cerium oxide reacts with sodium hydrogen phosphate at between 700°C and between 900°C, a temperature range that researchers say can be achieved with solar collectors. In the second reaction, the sodium-cerium phosphate is mixed with sodium carbonate and heated to 850°C. The product is carbon monoxide. If that reaction takes place in the presence of steam, the carbon monoxide reacts with water to form carbon dioxide and hydrogen. The other product of the reactions, sodium orthophosphate, is treated with carbon dioxide and water to yield salts that can react with the cerium compounds in the next cycle.

A major disadvantage of the technique is the need to separate those salts from water, Bamberger and Robinson say. Advantages include the low cost and low corrosivity of the chemicals. Chemical engineers are now assessing the commercial feasibility of the process. □

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## Breeder: Not dead yet

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The House of Representatives has locked horns with the Carter administration once again on whether or not to kill the Clinch River Breeder Reactor demonstration project. Last week the House voted down—237 to 182—an amendment to the Energy Department's fiscal-year 1980 authorizations bill that would have cut CRBR-completion funds; \$600 million has been spent on the project, which could cost \$2.6 billion if completed. Another version of the bill, reported out of committee on the Senate side — and without CRBR funding — awaits a vote by the Senate.

While supporting breeder-reactor development in general, President Jimmy Carter condemns CRBR in particular on the grounds that its design is "obsolete," that it is unnecessary at the present time and that it poses a threat to nuclear-weapons proliferation by creating plutonium. What's more, Carter has already threatened to veto the authorizations bill if it comes to him with CRBR funding. □