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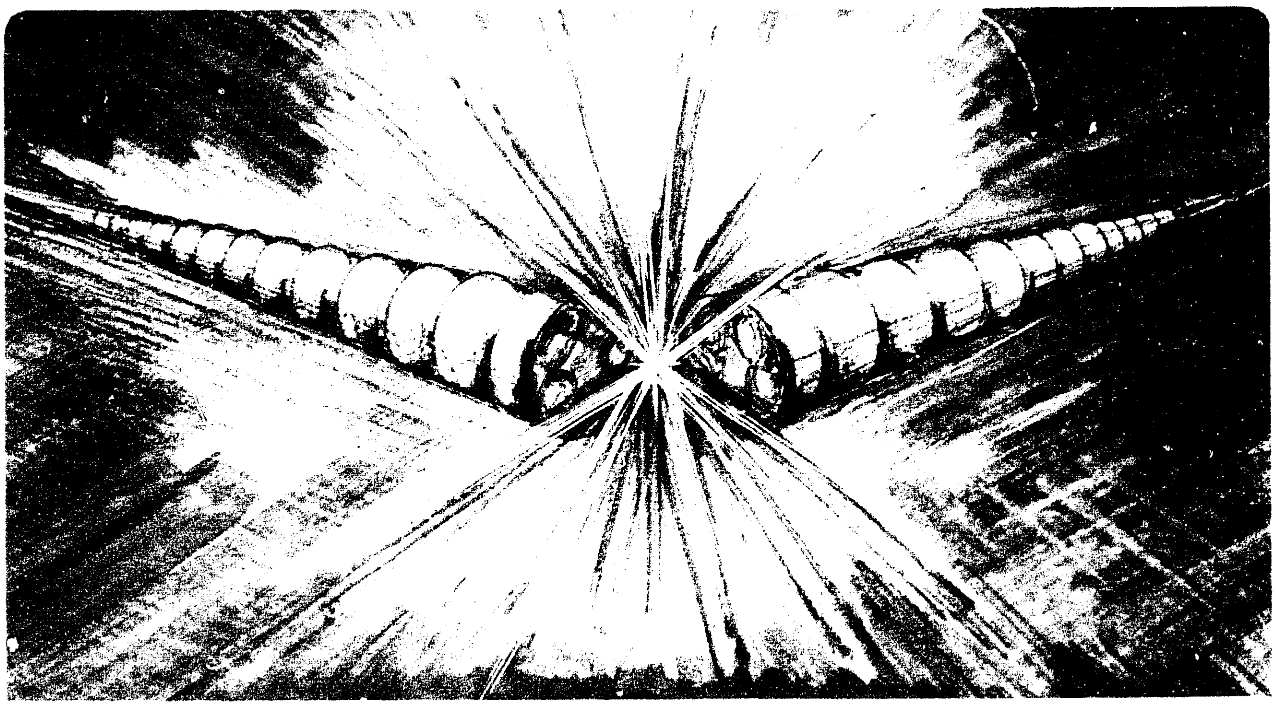

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FUTURE BIOMEDICAL RESEARCH AT THE BEVALAC*

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In the early 1970s, ions heavier than protons were accelerated[1] in the Bevatron, a weak-focusing synchrotron which was completed in 1954 for acceleration of protons. It enabled the initiation of pioneering studies of biological effects of high-energy light and heavy ions.[2] The construction of the Bevalac accelerator complex,[3] in which the superHILAC injects ion beams into the Bevatron for biomedical as well as nuclear science research, expanded the opportunity for medical studies with heavy charged-particle beams. Clinical trials for treating human cancer using heavier ions have been in progress at the Bevalac since 1975.[4] Ions of clinical interest have ranged from ^{4}He to ^{28}Si; the most commonly used ion has been ^{20}Ne with energies per nucleon of 456 and 585 MeV. Radiation biology and biophysics experimenters use all species of ions ranging from protons to uranium.

At the present time funding for Bevalac operations for all its research programs comes from DOE's Office of Nuclear Physics. Because of changing priorities in nuclear physics, we have been informed that support from this Office for the Bevalac will cease in 1995. Various methods are being investigated for maintaining an accelerated light and heavy ion capability for the biomedical research at LBL. One of these is a proposal to NASA to operate the Bevalac as a cosmic ray factory for space radiation effects research.

The Bevalac presents unique opportunities to NASA because its energetic beams of light and heavy ions can realistically simulate almost all of the cosmic-ray spectrum in a laboratory environment. NASA has taken advantage of this capability for many years by conducting materials studies, calibrating detectors, and performing basic space-science research. In support of planned manned planetary missions beyond the magnetosphere, the program would be expanded greatly into three main areas:

- Radiation biology, studying the effects of HZE (high charge and energy) particle induced mutagenesis and carcinogenesis.
- Materials science, characterizing the effectiveness of shielding materials and the radiation resistance of equipment.

- Space physics, a basic-science corollary of the manned-mission research, seeking to understand the interactions of cosmic rays with, for example, interstellar gas clouds.

This pure and applied research builds not only upon the technical capabilities of the Bevalac, but also upon its existing research program. Present users of the facility, from LBL and elsewhere, would be among the scientists proposing research within the NASA program. Under this proposal, NASA would significantly increase its current low level of Bevalac usage beginning in fiscal year 1992, sponsoring additional operation on nights and weekends during the 22 weeks per year in which the Bevalac is used solely for the therapy program. The total NASA program would ramp up from its current level of about 300 hours of research beam time per year to 1000-plus hours. Meanwhile, the current nuclear-science and biomedical programs would continue. After FY 1994, NASA and NASA-supported research would comprise the entire base program at the Bevalac. Other agencies might purchase additional beam time. Recently NASA has decided to establish a NASA Specialized Center of Research and Training for space radiation health for a Colorado State University/LBL Consortium. The NSCORT will carry out much of its research and training using the light and heavy ion beams at the Bevalac.

With these provisions, the Bevalac could continue in its role as an advanced biomedical research facility well into the next century.

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