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and attainment of equilibrium, annual recoveries are expected to be about a hundred grams of curium, milligrams of berkelium (97), grams of californium (98), tens of milligrams of einsteinium (99), and about a milligram of fermium (100).

NRL electron ring

The Naval Research Laboratory has constructed a small electron storage ring, the Sozotron, to study intense electron beams. Its designers plan to investigate normal modes of oscillation, loss and instability mechanisms, and other significant behavior of strictly space-charge-limited beams.

The "strict" space-charge limit permits a much denser beam than the "usual" space-charge limit of conventional circular-accelerator theory. The strict space-charge limit is set by a balance between focusing forces exerted by magnets and disruptive Coulomb forces between the particles. In this case thermal pressure gradients play a negligible role in the radial outward force. (The term "thermal pressure gradients" is used to denote the effect of random transverse motions of the electrons because of the analogy with the behavior of gases.) The usual space-charge limit in conventional machines is set by the space charge necessary to cause the single-particle oscillation frequency to resonate destruc-

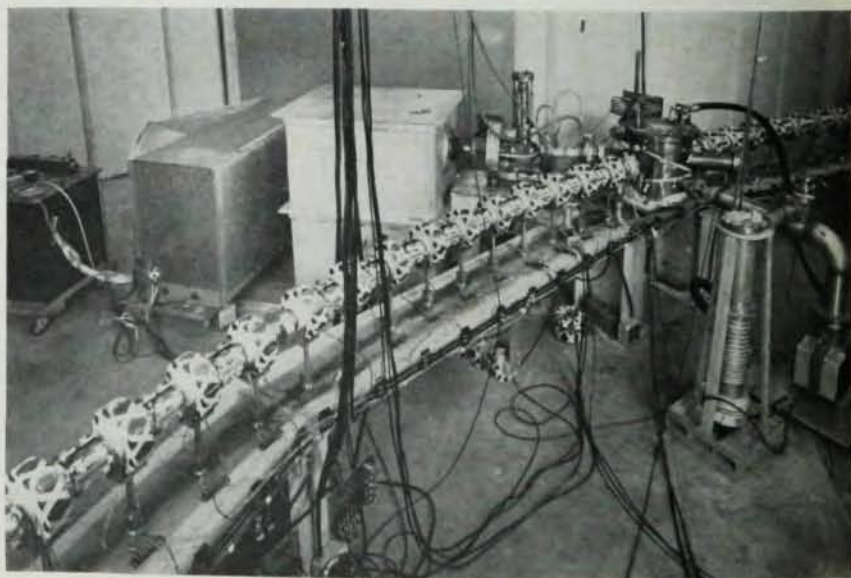
tively at some multiple of the revolution frequency. Here the thermal pressure gradients play a dominant role.

The Sozotron beam comes from a klystron at an energy of 100 keV and has an intensity of about 4 A. It is injected into a single turn by means of a fast-turn-off deflector having a constancy of deflection field over the deflection time interval better than one percent. If the beam can be shown to be stable or made stable for about 1 msec under (strictly) space-charge-limited conditions, the possibility of increasing the beam energy to about 100 MeV by betatron acceleration will be considered.

Further plans call for an increase of injection energy to 1 MeV. If the storage problems connected with the original 4-A beam can be satisfactorily solved, an increase in the contained current by a factor of a hundred should be possible when the 1-MeV injector is used.

So far, containment time is about 2 microsec, and the current is about 1 A at the end of this time. Much time has been spent in developing diagnostic equipment to provide a complete accounting for the fate of the beam; efforts to extend the containment time are expected to resume shortly.

The principal scientists involved are D. G. de Packh and J. B. Ehrman.



A view of Sozotron, the electron storage ring at the US Naval Research Laboratory, in the neighborhood of the machine's injector