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Strong-Focusing Cyclotron: High-Current Proton Accelerator for ADS Fission, Medical Isotope Production, and Proton Cancer Therapy

PETER MCINTYRE, Texas A&M Univ — The cyclotron is one of the oldest and simplest particle accelerators, but the beam current that can be accelerated is limited by the overlap of succeeding orbits and by the inability with weak focusing to control the betatron tunes during acceleration. The strong-focusing cyclotron remedies both problems by using superconducting 1/4-wave cavities to provide sufficient energy gain per turn to fully separate orbits and by locating alternating-gradient beam transport channels in the sector dipoles to provide strong-focusing control of betatron motion. It can accelerate ten times more beam current than any existing accelerator: >10 mA CW up to $\sim$ 800 MeV kinetic energy. The SFC provides the performance needed for ADS fission to destroy the transuranics in spent nuclear fuel; to synthesize 99Mo and other isotopes for nuclear medicine, and to provide high-brightness beams for pencil-beam cancer therapy.

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