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The Centrifugally-Confined Mirror Machine as a Fusion Reactor[1]

IAN ABEL, ADIL HASSAM, University of Maryland, College Park — There is renewed interest in the broader fusion community for examining alternative routes to fusion reactors. Here we present a new look at one promising configuration – the centrifugally-confined mirror. Initial explorations of this concept were performed on the Maryland Centrifugal Experiment (MCX) [Ellis et. al. Phys. Plasmas 8, 2057]. These experiments demonstrated sustained supersonic rotation and good momentum confinement [J. Ghosh et. al. Phys. Plasmas 13, 022503]. This is a promising concept because of its simple magnetic configuration, low recirculating power, and long-pulse capability. We present theoretical analyses of a reactor design based on this concept. We provide kinetic equilibrium calculations including collisional end-losses and magnetic equilibria that incorporate the effects of both supersonic rotation and pressure anisotropy. We also calculate profiles based on classical confinement of particles, heat, and momentum. Confinement of and self-heating by fusion products is taken into account in these calculations. With these theoretical tools, we design a reactor operating point. We present both a high-density, high-temperature design and a conservative design. We use these to predict the most important physics for a next-step experiment to resolve.

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