A Particle Core Model for Space Charge Dynamics in Rings*, J.D. GALAMBOS, J.A. HOLMES, D.K. OLSEN, ORNL; S.Y. LEE, Indiana Univ - High power circular accelerators and storage rings have both stringent beam loss requirements and significant space charge forces. It is therefore important to study the space charge dynamics and halo formation in rings. For linear accelerators, particle core models (PCM) have proven to be computationally fast, tractable to analytic methods, and to provide insight into the physics of halo formation. However, due to complications arising from the interaction of space charge and dispersion, PCM have not been developed for circular accelerators. We present a self-consistent PCM for the calculation of transverse space charge dynamics in rings. The model includes the effect of dispersion in representing the space charge force of the beam as a superposition of effective envelope equations for pure betatron motion. Also, space charge correction terms appear in the betatron focusing functions and in the dispersion function. The overall dynamics involves the interactions of the envelope with the lattice, the tracked particles with the envelope, and the tracked particles with the lattice. Particle tracking calculations are presented comparing the effects of space charge in similar doublet and FODO lattice configurations.

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