计算数学所定期学术报告

报告题目：Volume-preserving algorithms for charged particle dynamics

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摘 要 ： The paper reports our recent development of the splitting technique for the charged particle motion under the Lorentz force. The source-free nature of the Lorentz vector field has been investigated. Based on the volume-preserving property of the dynamics, a class of numerical methods for advancing the charged particles in a general electromagnetic field has been constructed by splitting the classical evolution operator. This new class of numerical methods, which includes the Boris algorithm as a special case, can conserve phase space volume, and globally bound the numerical errors in energy, momentum, and some adiabatic invariants up to the order of the method over a very long simulation time. The derived numerical methods can be computed explicitly, and thus are effective for the long-term simulation of the multi-scale dynamics of plasmas.