30E07P

非定常磁場に対するジャイロ運動論
Gyrokinetic Theory for Nonstationary Magnetic Fields

洲鎌英雄，渡邉智彦，沼波政倫
Hideo SUGAMA, Tomo-Hiko WATANABE, Masanori NUNAMI

核融合研，総研大
NIFS, SOKENDAI

The gyrokinetic theory is a basic framework for describing microinstabilities, turbulence, and resultant anomalous transport in magnetically confined plasmas [1-3]. In conventional gyrokinetic theories, the gyrocenter phase-space variables are defined by using the background magnetic confinement field that is assumed to be independent of time. Recently, several studies have been trying to perform long-time gyrokinetic turbulent transport simulations up to the transport time scale although they still use the above-mentioned assumption. However, the background or equilibrium magnetic field changes along with the pressure profile on the transport time scale. Therefore, in order to accurately describe the long-time behaviors of the gyrokinetic turbulence, we need to treat the time-dependent background field and show how to determine its time dependence. In this work, the gyrokinetic field theory [1] is extended to derive the condition which determines the time-dependent magnetic confinement fields in axisymmetric toroidal systems. Then, conservation laws of energy and momentum including the part of the time-dependent background fields are naturally derived from the extended gyrokinetic field theory.

[1] H. Sugama, “Gyrokinetic Field Theory”, Phys. Plasmas **7**, 405 (2000).
[2] 洲鎌英雄, 解説 “ジャイロ運動論”, プラズマ・核融合学会誌 **79**, 107 (2003).
[3] A. J. Brizard and T.-S. Hahm, “Foundations of Nonlinear Gyrokinetic Theory", Rev. Mod. Phys. **79**, 421 (2007).

This work is supported in part by the Japanese Ministry of Education, Culture, Sports, Science and Technology (Grant Nos. 21560861 and 22760660).