

Visitor Research Report

Visitor Name: Dr. Nobumitsu Yokoi
Institute of Industrial Science
University of Tokyo, Japan

Area of Research: Turbulence Modeling for the Magnetohydrodynamic
Plasmas Featuring Solar Winds

Period of Visit: March 12, 2008 through March 17, 2008

Goal: To validate a multi-equation turbulence model for magnetohydrodynamic (MHD) plasmas including the equation for the turbulence MHD residual energy (difference between the kinetic and magnetic energies) as well as the counterparts for the turbulent MHD energy, its dissipation rate, and the turbulent cross helicity (velocity–magnetic-field correlation).

Strategy: Because of the non-conservative property of the total amount of the residual energy, the exact equation for the turbulent MHD residual energy contains lots of terms in it. What terms should be incorporated into the model equation first should be discussed from the theoretical and numerical viewpoints.

Accomplishments: Through the discussions with the researchers in the NIA / NASA Langley during the visit, it was clearly understood that the nonlinear mixing terms coupled with the inhomogeneities of the mean velocity and magnetic field are most important, especially in the large-scale evolution of the solar-wind turbulence.

Future Work: There may be a few ambiguities in observational data concerning the deviation from equipartition between the kinetic and magnetic energies. This point should be further investigated. The effects of other terms should be also examined further.

Pending Publications: A paper entitled “A turbulence model for magnetohydrodynamic plasmas,” by the visitor and Robert Rubinstein of NASA Langley, with others, has been prepared for the publication in the Journal of Turbulence.

Seminar Presented: A seminar talk entitled “A Multi-equation Model for Magnetohydrodynamic Turbulence Featuring the Large-scale Evolution of the Solar Wind,” was presented on March 17 at Room 137 of the NIA. Active discussions on the subject have been made by audience during and after the seminar.