Behaviors of high energy particles observed by a lost ion probe on LHD

Masaki Nishiura[1]

[1] NIFS

The researches for thermo nuclear fusion plasmas are considered to make further progresses on physics and technologies, because of the decision of the international thermonuclear experimental reactor (ITER). To achieve the project successfully, high temperature and high density plasma must be confined and maintained with the nuclear fusion reactions such as DD and DT. It is essential to understand the behaviors of high energy particles (protons, alphas, and tritons), which are the products due to these reactions for the achievement of thermo nuclear fusion reactors.

We have developed the lost ion probe in the Large Helical Device (LHD) of the National Institute for Fusion Science (NIFS). This diagnostic device can measure the pitch angles and energies of high energy ions from the information on the luminescence positions on the scintillator. The signals are recorded by the image intensified CCD camera and the photomultipliers. From the analysis of camera images, the behaviors of high energy ions can be understood in details at the peripheral of LHD plasmas.

Because the lost ion probe is used under the severe conditions of high temperature and high density plasmas, it becomes a key issue to develop the heat resistance scintillator and the optical lens system. In the present, ZnS:Ag is utilized as a scintillator material. This material has a good light emission intensity, but the intensity drop down to zero at more than 300 degree centigrade. In the ITER diagnostic tool, since it is considered to be the temperature of more than 300 degree centigrade, we have started to develop the new scintillator materials like YAG:Ce and others, which can use under the high temperature and high radiation ray. These properties are reported in this presentation.

From the analysis of the lost ion probe signals, the influence of high energy particles on plasma confinement and the plasma-wave interactions related with Alfven waves and magnetic fluctuations will be discussed.