Development of new experimental device focusing on weakly ionized magnetic reconnection using rotating magnetic field

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Magnetic reconnection is a universal phenomenon in magnetized plasma such as fusion plasma, magnetosphere and solar atmosphere. It changes magnetic field topology and convert magnetic energy to kinetic and thermal energy of plasma. A large number of experimental studies have been implemented to investigate the physics of magnetic reconnection in fully ionized condition while there are little experimental studies on magnetic reconnection in weakly ionized condition. It is considered that the behavior of magnetic reconnection in weakly ionized plasmas, e.g. in solar chromosphere, is different from fully ionized case because not only Hall effect but also "ambipolar diffusion effect" caused by interaction between ions and neutral particles have influence on magnetic diffusion. Therefore, we are developing a new experimental device to uncover the importance of ion-neutral collision during magnetic reconnection in weakly ionized plasmas.

We employ a rotating magnetic fields technique driven by the combination of IGBT inverter circuits and series LC resonant circuit, which generates steady azimuthal plasma current, in a stainless vacuum vessel with diameter of about 40 cm to establish long-duration anti-parallel reconnection in weakly ionized plasma. We successfully formed and maintained two axially aligned RMF-FRC plasmas for about 4 ms while its magnetic field was as high as 1 mT. We are trying to control the two RMF-FRCs to generate magnetic reconnection. We will present development status and initial results from the new experiment.

* This work was supported by Grant-in Aid for Scientific Research (KAKENHI) 16K14525, 15H05750, 15K14279, 26287143, and the NIFS Collaboration Research program (NIFS15KBAR012, NIFS15KNTR001, NIFS16KOAP030).