S001-01
A 会場 ：11/4　PM1 （13:45-15:30）
13:45〜14:10

磁場閉じ込めプラズマを利用した統計加速の実験室模擬

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Experimental simulation for stochastic acceleration using magnetically confined plasmas

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Stochastic Fermi acceleration is commonly known as a mechanism for producing non-thermal high-energy particles in space. The acceleration mechanism is characterized as formation of power-law spectrum and longer heating timescale. In this study, we report on the stochastic acceleration observed in a magnetically confined torus plasma device, Heliotron J. The relativistic electrons circulating the Heliotron J torus (parallel to the magnetic field line) can be confined in the vacuum magnetic field, because a closed magnetic flux surface is formed only by the external coils. When non-resonant 2.45 GHz microwaves were launched in the vacuum magnetic field, the high-energy electrons with the energy exceeding 2 MeV were observed from the X-ray spectrum and the synchrotron radiation measurements. Since the normalized vector potential a_0 using the electric field of the microwave is less than 0.05, being much smaller than that for the laser plasma particle acceleration, the electrons need to be accelerated many times by the electric field to exceed the electron rest energy. The observed X-ray spectrum, taking the shielding effect of the vacuum vessel into account, has a power-law spectrum with exponent of -2.3. The electron acceleration simulation reveals (1) the formation of the power-law spectrum similar to the experimental observation, (2) the characteristics of the heating timescale (˜ms) longer than the torus circulating period (˜100ns) and (3) the existence of the threshold energy for the initial electrons to produce the relativistic electrons.