

**Central solenoid-free current startup with electron cyclotron wave preionization  
in SUNIST**

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**Abstract:**

A 100 kW, 2.45 GHz magnetron microwave system will be used to produce preionization plasma in the SUNIST, the first ST in China. Besides the toroidal field, a vertical field will be applied to generate a preliminary toroidal plasma current without action of the central solenoid.

In the first phase, a weak vertical field will be applied. In such a field configuration, a vertical component of the parallel velocity for some electrons moving in one toroidal direction will be introduced and may cancel the toroidal drift and form circular trajectories. On the contrary, the electrons moving in the opposite direction will be lost through contact with the vessel wall. Then the difference in confinement time between two moving directions will result in a net toroidal current.

Another current startup scenarios in the same field configuration will also be tested. A pair of electrodes is installed on the top and on the bottom of the vacuum vessel and a voltage will be applied to these during discharges. As the microwave beam is injected and the plasma is produced, a discharge between the electrodes will be triggered, and the electrons will move follow the oblique field lines and move around the torus many times until arrive at other electrode. Then a toroidal current will form.

The above two current generation mechanism with a toroidal field and a weak vertical field have been experimentally demonstrated in a small conventional tokamak CT-6B, and will performed in the SUNIST.

In the second phase of the discharge, the vertical field will be increased when the plasma current introduced using the above mentioned methods attain a saturated value. The vertical field will produce a varying magnetic flux through the toroidal plasma and induced more toroidal plasma current.

The experiment will conducted in the SUNIST this year.