

Microwave Spherical Torus Experiment toward Compact Fusion Reactor

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Fusion power may be a major energy resource free from CO₂ emission in future. The International Thermonuclear Experimental Reactor (ITER) project has been approved and the construction phase has just started for experiments after 2016 to prove DT fusion burning in tokamak magnetic confinement system. There is, however, a concern in fusion reactors of conventional tokamak type. They are large and their construction cost may not meet the economical requirement. In these circumstances, Spherical Tokamak (ST) concept has been developed to overcome the concern on the reactor size. Furthermore, a reactor design study on Very Compact Tokamak Reactor (VECTOR) has shown that removal of the center solenoid (CS) from tokamaks makes the reactors drastically compact and simple in structure, thus the economical requirement may be fulfilled.

Without CS, another method is required to start plasma discharge and drive the plasma current toward full plasma current for confinement of burning plasma. Recent experiments in the Low Aspect ratio Torus Experiment (LATE) device in Kyoto University has demonstrated that ST plasma can be formed by injection of microwave power alone without CS. The plasma has been initiated and started-up by electron cyclotron heating by injected microwave.