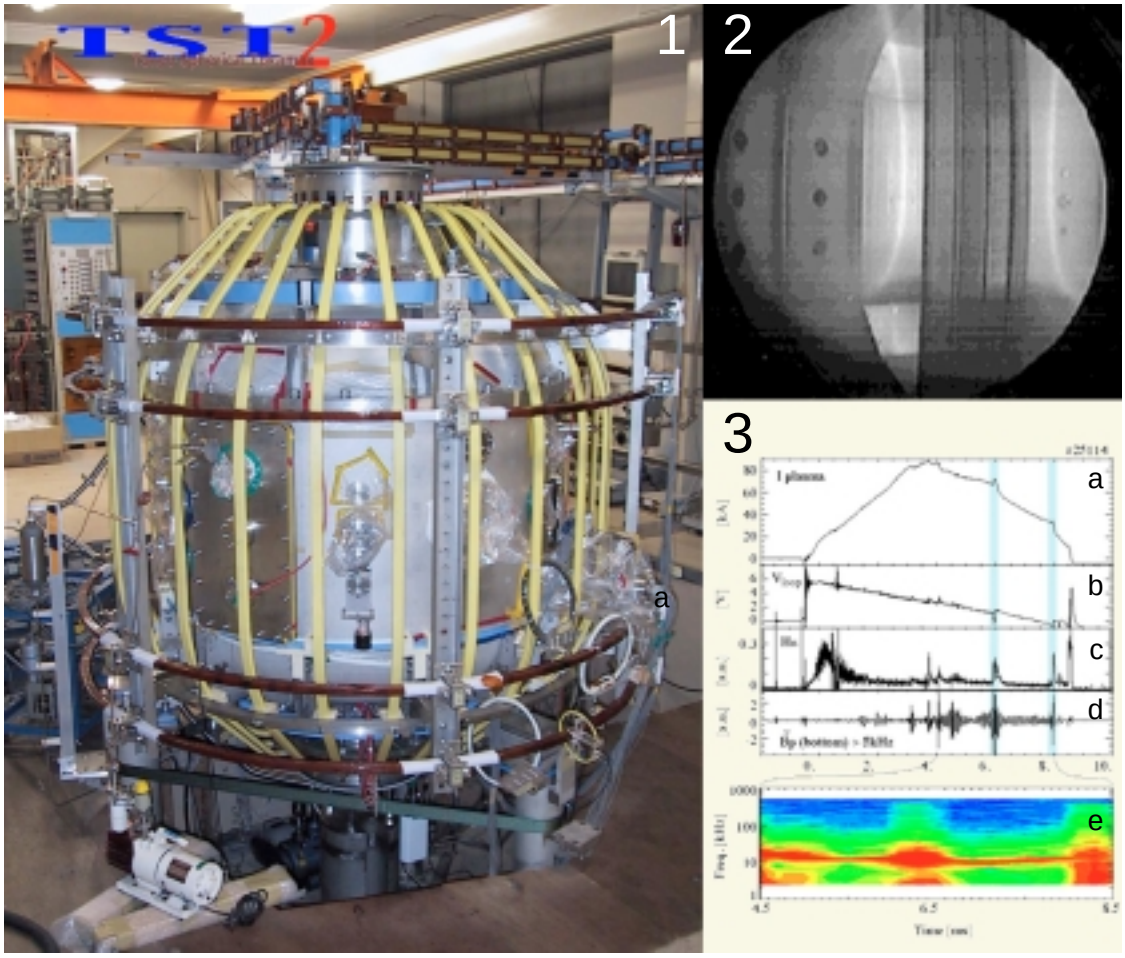
TST-2 fusion plasma experiment



Nuclear fusion is the process that powers the sun and stars. If this process could be used to produce energy on earth, it would solve most of the energy and environmental problems that are anticipated to confront us in the near future. In order to make this a reality, a dense and hot plasma must be confined for long enough time to produce sufficient fusion reactions. The most technically advanced confinement scheme is the tokamak which uses both externally-imposed and self-generated magnetic fields to confine the plasma. Recently a more physically advanced confinement scheme called the spherical tokamak (ST) is attracting attention world-wide. The ST can confine plasmas with much higher pressures than the tokamak for the same magnetic field, and therefore could lead to a more efficient reactor.

A new ST device TST-2 (Plate 1) was constructed in 1999. It is the largest ST experiment in Japan. TST-2 can generate very high temperature plasmas that are typical examples of a nonlinear complex system that are far away from thermal equilibrium. It has already achieved about half of the design parameters, producing plasmas with temperatures of approximately 1,000,000 degrees. It is expected to achieve its full design capability in 2000. A visible light image (mostly H_α emission) of the plasma is shown in Plate 2. The bright contour represents the plasma boundary where a cold plasma can radiate efficiently. Typical waveforms of representative observables are shown in Plate 3. The blue shaded regions indicate occurrences of a relaxation phenomenon peculiar to the ST, called the IRE (see I. §6.3 for details).

(Takase Group, I. §6.3)