IPPA Boundary Physics Goals on Spherical Torus (3.2.1)

5-Year Objective: Make preliminary determination of the attractiveness of the spherical torus (ST), by bootstrap operation, and acceptable divertor heat flux, for pulse lengths much greater than energy confinement times.

Implementing Approaches

3.2.1.5 Disperse Edge Heat Flux at Acceptable Levels : Study the dispersion of edge heat flux over a range of externally controllable parameters and estimate the plasma facing component requirements under high heating power in the spherical torus magnetic geometry. Determine the ability for managing intense energy and particle fluxes in the edge geometry and for increasing pulse durations significantly beyond the energy confinement time. **Most elements of the physics on the edge open field lines are shared between the ST and the tokamak, while the ST introduces stronger variations of the magnetic field strength along the field lines, that are closer to the magnetic mirror. The "toroidal mirror" configuration also tends to have large flux expansion in the divertor region, likely extending the physics research to new parameter regimes.**

IPPA Goals on Boundary Physics (3.1.4)

What are the fundamental processes occurring near the boundary of a confined plasma and how can the interaction between the plasma and material surfaces be controlled?

5-Year Objective: **Advance the capability to predict detailed multi-phase plasma-wall interfaces at very high power- and particle-fluxes**.

Progress will be measured by the level of agreement between models of physical processes in the edge region and experimental measurements, and by the capability to control energy and particle exhaust from a hot plasma.

- plasma edge physics
- coupling between edge and core plasmas
- plasma wall interactions

IPPA Goals on Boundary Physics - edge transport (3.1.4)

Implementation Approaches:

3.1.4.1 Plasma Edge Physics : Develop physics understanding reliably to predict scrape-off layer widths and radial electric fields in the edge region. Develop theory and modeling for plasma transport along the magnetic field over regions in which the collisionality (ratio of mean-free-path to gradient scale-length) shows wide variation. Enhance diagnostics necessary to identify sources of core impurities. Determine effect of non-Maxwellian electron distributions on atomic transition rates. Extend and refine models of plasma radiation and opacity in the presence of sharp gradients.