

# Common Task B: Liquid Wall-Bulk Plasma Interactions

---

R. Kaita

with contributions from M. Chance, S. Jardin, C. Kessel,  
J. Manickam, R. Majeski, N. Pomphrey, J. Schmidt, D. Stotler,  
R. Woolley, L. Zakharov, and S. Zweben

Princeton Plasma Physics Laboratory\*  
Princeton, New Jersey

APEX-7 Meeting  
Los Angeles, California  
November 8 - 11, 1999

\*Under US DOE contract #DE-AC02-76-CH03073



## Task I. Explore options and issues for implementing a flowing liquid wall in NSTX

---

- ◆ I.1 Characterization of NSTX operating conditions (PPPL \$30k)
  - Contact: M.Peng. More discussion needed to identify personnel for task
  
- ◆ I.4 LM experimental facility set up and initial exploratory experiments with and without magnetic field gradients and applied currents (PPPL - \$20k)
  - Use to support facility at UCLA (R. Wooley)
  
- ◆ I.5 Identification of key issues and development of an R&D plan for implementing liquid walls in NSTX (PPPL - \$20k)
  - Requires organization of working group to address this task

## Task I. Explore options and issues for implementing a flowing liquid wall in NSTX

---

- ◆ I.1 Characterization of NSTX operating conditions (PPPL \$30k)
  - Contact: M.Peng. More discussion needed to identify personnel for task
  
- ◆ I.4 LM experimental facility set up and initial exploratory experiments with and without magnetic field gradients and applied currents (PPPL - \$20k)
  - Use to support facility at UCLA (R. Wooley)
  
- ◆ I.5 Identification of key issues and development of an R&D plan for implementing liquid walls in NSTX (PPPL - \$20k)
  - Requires organization of working group to address this task

# MHD effects associated with liquid conducting walls

---

- ◆ Fluid motion during plasma startup (TSC)
  - Induced eddy currents and resultant fluid motion
  - Requirements on startup voltages
- ◆ Considerations regarding plasma elongation (TSC)
  - Effect of vertical feedback system on liquid wall
  - Limits on plasma elongation
- ◆ Personnel: S. Jardin, C. Kessel, and N. Pomphrey  
(PPPL - \$40k)

# MHD effects associated with liquid conducting walls (continued)

---

- ◆ Stabilizing effects of liquid walls on free-boundary plasma modes
  - Develop dispersion relation in simplified (straight) geometry
  - Quantify dependence of thickness and flow rate of liquid layer
  - Begin formulation of toroidal problem building on PEST, DCON, or NOVA
  
- ◆ Personnel: J. Manickam and M. Chance (PPPL - \$30k)

# MHD effects associated with liquid conducting walls (continued)

---

- ◆ New concepts for liquid walls
  - Further analysis of magnetic propulsion of intense liquid lithium streams and their effects on plasma stability
- ◆ Personnel: L. Zakharov (PPPL - \$40k)

# Task III. Practical Engineering Issues Associated with the Design of a Liquid Wall

---

- ◆ III.1 Mechanical Design, Maintenance, Integration
  - d) Conducting shell and other liquid-bulk plasma considerations (combine with PPPL effort for Task II.1)
  
- ◆ III.3 Liquid Wall Fluid Flow Configuration and Design
  - c) Liquid-bulk plasma interactions (PPPL - \$10k: use to refine DEGAS 2 neutral transport code with further measurements from plasma surface interaction experiments)
  
- ◆ Personnel: D. Stotler (PPPL - \$10k)