PPPL Perspective and Strategy

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PPPL Perspectives and Strategy

• **Strong participation in ITER is essential** for the US and the world fusion program
  → ITER construction, predictive understanding of burning plasma

• **Innovation is needed to create shared excitement and opportunity within the US community and with our stakeholders**
  → alternative approaches to our common challenges, with viable development path
  → reduced cost and scale, but not excitement, for US next step

• **Strong linkages with other science areas** required for the long-term vitality of our community
  → space plasma, HEDP, plasma chemistry, ...
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PPPL & the US Delivered Major Contributions to ITER in 2017

• ITER Steady State Electrical Network delivered ($35M)
• Operational in March, final shipment in September.
• PPPL also managed the US community effort in diagnostics
Fusion exascale project explores core-edge integration building on key SciDac models (GENE+XGC1)

New insights gained from advanced multi-physics simulation on the path to exascale computing
PPPL is Leading an Effort to Measure and Understand the Origin of Rotation in Tokamak Plasmas

- Intrinsic rotation plays a key role in confinement and stability
- PPPL collaborates with DIII-D to directly measure deuterium rotation at low torque, and to
- Validate models of rotation for extrapolation to ITER
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NSTX-U Will Pursue Transformative Ideas to Enable Accelerating Fusion Development

Extend ST physics understanding to fusion-relevant temperatures, contrast to larger A tokamaks

Demonstrate sustainment for future steady-state operation

Test of liquid metals as transformative wall solution

Highest Priority: Successful NSTX-U Recovery is essential for PPPL and the US fusion program
LTX-β To Come Online in 2017: Explore Physics of a Liquid Metal Boundary

- Extends LTX parameters by adding neutral beam & raising $B_T$ by 70%

- International: New liquid lithium scraper developed and tested on EAST

- Beyond LTX-β; extension to NSTX-U
3D Physics Offers Innovative Opportunities for Improved Stability and Confinement

IPEC Prediction of stability

Space

PPPL trim coil on W7-X

Validation of predictive models for ELM suppression in KSTAR

Exploration of straight outer-coil configuration for optimized stellarator
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New Tools to Broaden Our Understanding of the Plasma Universe

- Fast reconnection underlies physics of stellar flares, astrophysical jets, fusion plasmas

- FLARE to come online in 2017, builds on pioneering MRX program

- Strong new initiatives in HEDP
  \[ \rightarrow \] X-ray imaging at NIF, …

- Low temperature plasma applications
  \[ \rightarrow \] Nano materials, plasma chemistry
PPPL Strategy is to focus on ITER, Transformative Ideas for Fusion and Expanded Connection to Other Fields

• Strong participation in ITER is a key element of the PPPL strategy

• PPPL pursues innovative approaches with the potential to reduce cost and scale of next step experiments

• Linkages to other science areas are expanding, providing exciting new opportunities