RECENT HIGHLIGHTS FROM C-MOD PROGRAM

APS-DPP October, 2003
For National Alcator Team
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OUTLINE

- ICRF
- Transport
  - Core
  - Pedestal
  - SOL
- MHD
- LHCD & Near-Term Plans
ICRF Heating at Very High Power Density

- High power operation.
  - 5 MW operation for 0.5 sec.
  - Flexible phase operation for 4 strap antenna.
- Significant sawtooth modification
  - Depends on antenna phasing
  - Current Drive
  - Fast Ions
  - Power Deposition
- Target scenario for current and flow drive experiments.

Lin – GI2.005, Wright – GI2.006
Wukitch – CO1.006, Schilling – FP1.002
Parisot – FP1.003, Yuh – FP1.015
**Transport Studies Span the Entire Plasma**

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<th>Core</th>
<th>Pedestal</th>
<th>Near Sol</th>
<th>Far Sol</th>
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<td>- Self-generated flows and momentum transport</td>
<td>- Profiles &amp; stability</td>
<td>- Profiles &amp; micro-stability</td>
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<td>- Neutral effects</td>
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<td>Scott – FP1.022</td>
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EVALUATION OF ROTATION PROFILES ALLOWS MOMENTUM TRANSPORT TO BE DETERMINED

- Self-generated flow profiles vary dramatically in different regimes
- Rotation profiles are flat in EDA H-mode – momentum diffuses from edge
- Evolution in ELM-free plasma demonstrates inward momentum convection
- Some similarities to impurity, particle behavior
- Comparisons with theory

![Graphs showing EDA and ELM-free plasma data](image-url)
ITB CONTROL – LOCATION OF BARRIER

- Previous work focused on control of barrier strength through mix of on and off-axis ICRF heating
- Barrier location can apparently be controlled by varying B field

- Open question is this a q or q’ effect (or something else)?

Fiore- Ul1.004, Ernst – Ul1.005, Redi – KO1.007
Optical measurements show QC radial extent < 4 mm – resolution limited

Probe measurements showed 1-2 mm but may perturb flux tube
CROSS-FIELD TRANSPORT IN SOL IS CRUCIAL FOR DYNAMICS OF EDGE PLASMA AND DIVERTOR

- Near-SOL – steep gradients, moderate fluctuations
  - Transport is not Bohm-like
  - Even in L-mode, shear layer with reduced transport is observed
  - Dependence on normalized pressure and collisionality space consistent with theoretical treatments (Rogers, Scott)
- Far-SOL – flat gradients, bursty or “bloppy” transport
LARGE POLOIDAL ASYMMETRIES IN SOL PROFILES AND FLUCTUATIONS ARE OBSERVED

- Scanning electrostatic probe and optical diagnostics are deployed at low-field and high-field locations
- Observations confirm ballooning nature of turbulence
- Lower levels of fluctuations and sharper profiles are seen in “good” curvature regions – especially in double null topology
- Significant flows are driven as plasma attempts to “re-symmetrize”

**Smick – FP1.012, LaBombard-CO1.002**
Locked modes implicated in high-current disruptions on C-Mod

7 new coils (A-coils) to investigate error fields and locked modes

Intrinsic error field ~0.35 mT
n=1, m=2 component dominant

Strong inverse size scaling of locking threshold (LaHaye ‘97) implied challenging sensitivity to error fields for ITER
  o Scaling Implications of C-Mod measurements
Near-Term Plans Emphasize AT Program Enabled by LH Current Drive

- Installation of 1st launcher this year – 3 MW source power at 4.6 GHz
- Waveguide phase control allows real-time control of launched spectrum
- High-efficiency off-axis current drive (r/a > 0.7)
- Goals are creation and control of AT regimes
  - For times longer than L/R time.
  - No core particle or momentum source
  - Coupled electrons and ions
  - High power density handled by metal first wall
- Enhanced core diagnostics (fluctuations, profiles)

Bonoli – CO1.008
Tang – FP1.006
Liptac – FP1.007