

31st European Physical Society Conference on Plasma Physics, Imperial College, London, 6/28–7/2 /04

- ~ 900 registered
- 4 parallel topical streams
 - Magnetic confinement fusion
 - Basic & astrophysical plasmas
 - Dusty & low temperature plasmas
 - Beam plasma & inertial fusion (2)
- 53 invited talks (19 MFE),
98 (17) contributed talks,
~800 (~450) contributed posters in four 2 hour sessions!
 - Hard to see all posters of interest
- J.B. Taylor received the Alfvén Prize
 - Contributions in MHD and relaxation to minimum energy state, scaling invariance, *etc.*

Opening address by Prof. David King, Chief Science Advisor to the UK Government

- Believes anthropogenic CO₂ is contributing to climate change
 - Evidence from ice cores now going back 0.8My
 - Cooler climatic periods for 220ppm CO₂
 - Warmer climatic periods for 260ppm CO₂
 - Now at 379ppm
 - Last summer's heatwave in Europe was 5 σ above historical record
 - 8 of last 10 years are records in global temperature
 - 50 – 200 M people may be displaced by flooding in next 45 years
- UK aims to cut *per capita* CO₂ 60% by 2050 from 8.5T p.a.
 - USA currently 21Tp.a. p.c.
 - Goal consistent with stabilizing at 550ppm
 - 450ppm safer against non-linear effects seen in modeling
- Strong proponent of fusion and ITER
 - “pleased that two of the parties are scrapping over the site”
 - ITER “should produce at least 10 times as much power as it consumes”!

JET

- Challis (I1-02): ITBs, particularly on JET
 - Fairly rosy assessment of potential, but did recognize that “.. local insulation is so good ... pressure gradients reach the stability limit.”
- Cordey (O1-05): β scaling and comparison with DIII-D
 - ITER global scaling implies $\beta^{-0.9} \nu^{-0.01}$, but
 - 2-point scans in DIII-D, JET imply $\beta \sim \nu^{-0.35}$
- Zastrow (I3-05): recent trace tritium experiments
 - 380mg of T gas, 20s T-NBI $\Rightarrow 4 \times 10^{18}$ DT neutrons
 - Measured T influx with 2D neutron collimator, spectroscopy
 - 2-point scans yield $D_T \propto \beta^{-1} \nu^0$!
 - D_T neoclassical in some high density and ITB plasmas
- Saibene (O4-02): small ELM experiments in JET (*c.f.* AUG)
 - $\beta_N \approx 2$, $H_{\text{ITER-98H}} \approx 1$, $n/n_{\text{GW}} \approx 1$ for $\delta = 0.4 - 0.5$, $q_{95} < 4$ with mixed I/II ELMS, *but*
 - $I_p = 0.87\text{MA}$, $B_T = 1.17\text{T}$, $P_{\text{NB}} = 3\text{--}4\text{MW}$, $W_{\text{tot}} \sim 0.6\text{MJ}$!
- Gormezano (I5-01): “Hybrid scenario”: low central shear, $q_0 > 1$
 - Particularly on JET, but also AUG, DIII-D, JT-60U
 - ITER relevance: $Q = 10$ at 12MA for 3000s
 - Recent JET experiments with dominant ICRF instead of NBI; $T_e \sim T_i$
 - Data from ASDEX, JET shows $\beta_{N,\text{max}} \propto \rho^*$ (*c.f.* TFTR experience)

Asdex-UG, Textor

- Guenter (O1-02): On-/Off- axis NBCD for profile control
 - Less off-axis NBCD than expected, particularly at high power
 - Want to use TRANSP to compare with ASTRA modeling
 - Is there a redistribution of fast ions by MHD and turbulence?
- Horton (I5-03): H-mode physics in AUG for ITER
 - High res. IR shows filamentation of divertor power during ELM
 - See QH-mode (as DIII-D) - sharper edge barrier *but* $Z_{\text{eff}} = 3 - 6$
 - Use pellet injection as “pace-maker” for small ELMs
- Finken (I2-06): Textor dynamic ergodic divertor
 - 16 separate helical coil segments, but only 4 supplies
 - $m=3/n=1$ or $m=12/n=4$ ($m=6/n=2$ not yet used); $f = 1, 2, 3.5, 7$ kHz
 - 8 moving strike zones + induces rotation *and* MHD tearing mode
 - Confinement degrades 30% *but* less than reduction in volume
 - Not as bad if use counter rotating DED

MAST

- Invited talk by Brian Lloyd (I5-02), plus many posters
- No new data since ST workshop (9/03) but more analysis
- Tracking pellets with fast camera and correlating with EFIT
- Using 2D imaging of VB to remove internal reflections
- Interesting results from counter-NBI campaign
 - High-res. T_e profiles with extreme gradients
- Claiming ITER relevance for
 - Aspect ratio
 - Separation of edge from core effects in confinement scaling
 - H-mode threshold scaling
 - Role of edge rotation and effects of inboard fueling
 - $\omega_{\text{ExB}} \sim \gamma_{\text{ITG}}$ in typical H-modes in MAST
- Resumption of experiments was then on hold because of a ground fault in the new center stack
 - Fault occurred during a high voltage test after operating test OK
 - Subsequently repaired by excavating failed insulation

Inertial Fusion

- “Fast ignition” with lasers, *e.g.* Tanaka (ILE Osaka, I2-01)
 - Use gold “guide cones” to funnel ps ignition pulse to compressed core
 - Achieved 60gcm^{-3} , 1keV, 2×10^7 DD neutrons
 - Would need 100kJ ($\times 10$ increase) for ignition
- Norreys (I1-01): Vulcan (Rutherford Appleton Lab.)
 - 500J in 650fs, 10^{21}Wcm^{-2}
 - Expect ponderomotive potential of $\sim 10\text{MeV}$, GB pressure
 - Generated proton beams to 50meV, magnetic field to 700MG
 - Also estimates $\sim 80\text{kJ}$ for ignition
- Haan (I3-02): NIF
 - Still aiming for 1.8MJ at $0.35\mu\text{m}$, but also reconsidering $0.53\mu\text{m}$ options
 - 1 “quad” of beams has produced now 43kJ
 - Now talking about capsules with 100MJ yield for ignition - $\times 5$ original
- Labaune (I4-02): LULI Palaiseau
 - Laser-pellet interaction physics - *e.g.* effects of hot spots
 - Spatial smoothing techniques