Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

High Particle Density Path to Fusion* B. COPPI, MIT, F. BOMBARDA, P. DETRAGIACHE, ENEA, A. AIROLDI, G. CENACCHI, CREATE, A. SESTERO — Experiments by the heliotron LHD machine have confirmed the outstanding confinement and purity properties of plasmas with peak densities $n_0 \sim 10^{21} m^{-3}$ that had been originally discovered and investigated by the high-field line of machines (Alcator and FT). The finding of these regimes opened the way to aim at reaching ignition conditions on the basis of existing knowledge of plasma physics and available technologies. The high field and high particle density approach represented by Ignitor [1] ($R_0 \cong 1.32$ m, $a \times b \cong 0.47 \times 0.86$ m^2, $B_T \leq 13$ T, $I_p \leq 11$ MA) remains the only one that can be pursued realistically in the near term in order to reach ignition. The choice of machine parameters have been guided by the criterion of optimizing the Ohmic and α-particle heating process, with the possible assistance of modest amount of RF power, and that of studying the physics and the control of meaningful burning plasmas in regimes sufficiently far from well known operational limits (e.g. density and β limits). Achieving these conditions (including, $t_{pulse} \sim \tau_{crd} \gg \tau_E \gg \tau_{sd}$) will provide the proof of scientific feasibility of power producing reactors. Studies of reactors concepts (e.g. material testing reactors, neutron sources, tritium poor reactors, etc.) based on the Ignitor approach are being reconsidered. *Sponsored in part ENEA of Italy and by the U.S. D.O.E.
[1] B. Coppi, A. Airoldi, F. Bombarda, *et al., Nucl. Fusion* **41 (9)**, 1253 (2001).

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Date submitted: 24 Jul 2009 Electronic form version 1.4