A “Polywell” p+^{11}B Power Reactor

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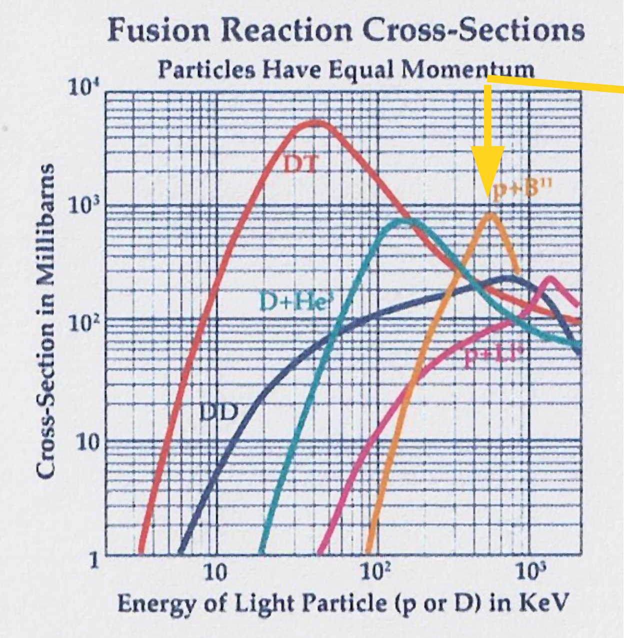
A new method was developed for operating Polywell with a view to maintaining the required non-Maxwellian electron energy distribution. The method extracts down-scattered electrons and replaces them with electrons of a unique higher energy. The confined electrons create a stable electrostatic potential well which accelerates and confines ions at the optimum fusion energy, shown in the graph below. Particle-in-cell(PIC) simulations proceeded in two steps, as follows: 1) operational parameters were varied to maximize power balance(Q) in a small-scale steady-state reactor; and 2) the small scale simulation results were scaled up to predict how big a reactor would need to be to generate net power. Q was simulated as the ratio of fusion-power-output to drive-power-input. Fusion-power was computed from simulated ion density and ion velocity. Power-input was simulated as the power required to balance non-fusing ion losses. The predicted break-even magnet diameter was 13m. Bremsstrahlung losses were also simulated and found manageable. These results are promising for building a net power reactor.



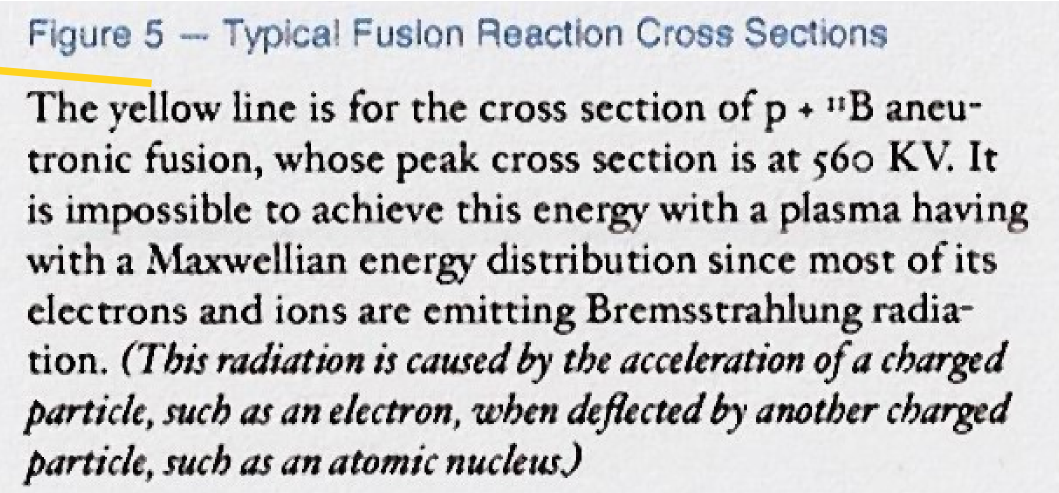


Figure 5 — Typical Fusion Reaction Cross Sections

The yellow line is for the cross section of p + ^{11}B aneutronic fusion, whose peak cross section is at 560 KV. It is impossible to achieve this energy with a plasma having with a Maxwellian energy distribution since most of its electrons and ions are emitting Bremsstrahlung radiation. *(This radiation is caused by the acceleration of a charged particle, such as an electron, when deflected by another charged particle, such as an atomic nucleus.)*

Robert W. Bussard, “Should Google Go Nuclear”, http://askmar.com/Fusion.html, November, 2006