Accelerator Based Fusion Reactor

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A feasibility study of fusion reactors based on accelerators is carried out. We consider a novel scheme where the beam from the accelerator hits the target plasma on the resonance of the fusion reaction to increase reactivity and establish characteristic criteria for a workable reactor. The critical temperature of the plasma is determined from the stopping power. The needed plasma lifetime is determined from the width of the resonance, the beam velocity and the plasma density. We estimate the critical beam flux by balancing the energy of fusion production against the plasma thermo-energy and the loss due to stopping power. While the critical temperatures based on the d + t, d + He^3 and p + B^{11} reactions turn out to be several times lower than the corresponding ones for the thermonuclear reactors and the triple product of plasma density, temperature and lifetime is about 50 times smaller than the Lawson criterion, the critical flux in the range of 10^{21} - 10^{23}/cm^2/s for the plasma density $\rho = 10^{14}$/cm^3$ can be a challenge. The above study is published*. We will present a follow up study on the conceptual designs of such reactors.

***Reference** K. F. Liu and A. W. Chao, ``Accelerator Based Fusion Reactor,"
Nuclear Fusion 57, 084002 (2017), doi:10.1088/1741-4326/aa7642, [arXiv:1707.03043]