

Development of a High-Flux Fusion Neutron Source Using Recent Advances in Technology

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Abstract: We report an overview of theoretical and experimental work at the University of Wisconsin leading to a fusion neutron source based on the Gas Dynamic Trap concept. The design considers the implications of several recent physics and technological advances and uses (1) off-the-shelf MRI magnets for an inexpensive central cell, (2) state-of-the-art small and planar high field REBCO magnet for plugs, (3) state-of-the-art gyrotrons to allow high density operation, (4) sloshing ions to localize neutron yield away from sensitive high field magnets at edge, (5) radio-frequency heating at the fast-ion turning points to enhance neutron yield, (6) a liquid lithium expanding divertor for heat removal, electron thermal barrier and MHD stability—lithium seems essential for pumping neutrals, minimize sputtering by ion bombardment, and minimize secondary electron emission to allow the electron thermal barrier to form. Equilibrium, stability, plasma heating have been modeled using a Grad-Shafranov solver for the mirror including fast ion pressure coupled to the CQL3D/Genray suite of codes. Initial results were extremely promising. 5 MW of neutral beam injection power and 5 MW of rf heating at 15 MHz generated 1015 neutrons/sec in DD. In addition, progress on the construction of a prototype GDT using REBCO mirror coils a lithium divertor solution will be reported.

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Primary author: Prof. FOREST, Cary (University of Wisconsin-Madison)

Co-authors: WHYTE, Dennis (MIT); Mr PETERSON, Ethan (University of Wisconsin, Madison); Prof. EGEDAL, Jan (University of Wisconsin, Madison); Dr ANDERSON, Jay (University of Wisconsin, Madison); Prof. SARFF, John (University of Wisconsin, Madison); Mr WALLACE, John (University of Wisconsin, Madison); Mr MINERVINI, Joseph (MIT); HARVEY, Robert W. (CompX); Mr WALEFFE, Roger (University of Wisconsin, Madison); Dr SIMONEN, Thomas (Berkeley); Dr MIRNOV, Vladimir (University of Wisconsin, Madison); Dr PETROV, Yuri (CompX)

Presenter: Prof. FOREST, Cary (University of Wisconsin-Madison)

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