Experiment to Study Alfven Wave Propagation in Plasma Loops

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Solar coronal loops are simulated in the laboratory using pulsed power techniques [1]. We are now developing a method to excite propagating torsional Alfven wave modes in these loops by superposing a current pulse of roughly 10kA and width 100ns upon the ~50kA, 10μs main discharge current that flows along the ~10cm long, 1cm diameter arched flux tube. To achieve this short 100ns pulsed timescale at such high power, a magnetic pulse compression technique based on saturable reactors will be employed. A low power prototype has been successfully tested, and design and construction of a full-power device is underway. The present device will compress an initial 2μs pulse by a factor of nearly 20; the final stage will utilize a water-filled transmission line with ultra-low inductance to help achieve such a short timescale. Upon completion, the fast current pulse device will be used to investigate interactions between the Alfven waves and the larger-scale loop evolution. Particular attention will be paid to wave propagation including dispersion and reflection, as well as dissipation mechanisms and possible energetic particle generation.

[1] J. F. Hansen, S. K. P. Tripathi, P. M. Bellan, "Co- and Counter-helicity Interaction Between Two Adjacent Laboratory Prominences," *Phys. Plasmas*, vol. 11, issue 6, p. 3177, 2004