Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

A Laboratory Model for the Parker Spiral and Magnetized Stellar Winds ETHAN PETERSON, MIKE CLARK, JAN EGEDAL, DOUGLASS ENDRIZZI, KEN FLANAGAN, JASON MILHONE, JOSEPH OLSON, JOHN WALLACE, CARL SOVINEC, CARY FOREST, University of Wisconsin - Madison — A laboratory system that mimics the formation of magnetized stellar winds by driving Alfvénic plasma flows in a dipole magnetic field is presented. Plasma dynamics near the Alfvén surface are observed and involve magnetic reconnection and plasmoid ejection. These plasmoids are formed by ballooning perturbations that are driven by an accretion process. A radially inward Hall electric field is established by the magnetospheric ring current crossed with the poloidal magnetic field which causes the ions to accrete inwards until the pressure gradient becomes large enough to drive ballooning modes. These perturbations stretch the dipolar field lines into the current sheet until reconnection occurs, launching plasmoids into the stellar wind much like the quasi-periodic plasma blobs observed in the solar wind by LASCO. When the system is driven hard enough, the current sheet becomes thin and long, allowing for current driven instabilities to occur as well - forming much smaller plasma blobs at higher frequencies. Two-fluid simulations performed with the NIMROD code corroborate that in this helmet streamer-like magnetic geometry both pressure driven and current driven instabilities can be present and give rise to periodic plasma blob ejection amidst a bath of broadband fluctuations.

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Date submitted: 03 Jul 2019 Electronic form version 1.4