

Abstract Submitted  
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**Sausage, Kink and Spheromak Formation** SETTHIVOINE YOU, PAUL M. BELLAN, Caltech — Observations from the Caltech spheromak experiment motivate a revisiting of the sausage and kink instabilities. A collimated, current-carrying magnetic flux tube (center column) is observed to “detach” from the gun at high  $\lambda$  (ratio of gun current to imposed magnetic flux). This detachment appears to be initiated by a sausage instability. Previous measurements [1] indicated the kink instability of this center column is a precursor to spheromak formation. A flux-amplifying kink of the column occurs first, quickly followed by a detachment and spheromak formation. Furthermore, recent results [2] have shown that before kinking, dynamic and stagnating plasma flow is responsible for flux tube collimation -as predicted by the gobble/collimation theory [3]. Ideal MHD linear stability analysis of a diffuse current pinch (using the energy principle and including a skin current and magnetic field relationships from [3]) maps out a  $k$  vs  $\lambda$  operating space, where  $k$  is the inverse length. The space includes  $m = 0$  and  $m = 1$  instability regions that are modified from classical thresholds. Measurements of  $k$  and  $\lambda$  throughout the duration of the plasma discharge then trace a path in the operating space. Hence, the observed evolution of the plasma column may suggest an answer to a novel question: is sausage instability another necessary condition for spheromak formation? [1] S.C.Hsu, P.M.Bellan, PRL, 90, 215002 (2003) [2] S.You, G.S.Yun, P.M.Bellan, PRL, (2005) in press [3] P.M.Bellan, Phys.Plasmas, 10, 5 (2003) 1999.

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