Abstract Submitted for the DFD10 Meeting of The American Physical Society

Langmuir circulation in the presence of lateral density gradients¹ GREG CHINI², KE LI³, University of New Hampshire — Comparably little is known about the impact of lateral density gradients (associated with, e.g., submesoscale fronts) on Langmuir circulation in the ocean surface mixed layer. Here, 2D pseudospectral numerical simulations of the laterally stratified Craik–Leibovich (CL) equations are performed to elucidate the effect of an imposed horizontal density gradient on Langmuir cells. The dominant mode of instability consists of counterrotating cells with up- and downwelling jets inclined to the vertical. Linear stability analysis confirms that although no instability occurs in the absence of the CL vortex torque, the dominant instability mode exhibits growth rates exceeding those realized in a constant density fluid. An energy budget is used to gain insight into the physics of this cooperative instability. The fully nonlinear simulations reveal a secondary instability, in which the tilted cells are laterally sheared, and a subsequent energy cascade to fine scales.

¹GC gratefully acknowledges funding from NSF CAREER Award 0348981. ²Program in Integrated Applied Mathematics ³Mechanical Engineering Department

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Date submitted: 03 Aug 2010

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