Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Hearing and Infinite-Period Bifurcations SEUNG JI, UCLA, DOLORES BOZOVIC, ROBIJN BRUINSMA, UCLA — Auditory and vestibular systems present us with biological sensors that can achieve sub-nanometer sensitivity orders of magnitude in the dynamic range, while operating in a fluid-immersed, room-temperature environment. While the mechanisms behind this extreme sensitivity and robustness of the inner ear have not been fully explained, nonlinear response has been shown to be crucial to its proper function. Recent experiments have recorded innate motility of hair cells of the bullfrog sacculus, under varying degrees of steady-state offset. The bundle deflection was shown to suppress or enhance spontaneous oscillations, and affect the sensitivity of the mechanical response. We will present a theoretical model based on cubic nonlinearity and show that in different parameter regimes, the system can be induced to cross a supercritical Hopf bifurcation, an infinite-period bifurcation, or a multi-critical point. Comparing the numerical simulation to the experiment, we will present evidence that the multi-critical point corresponds most closely to the dynamic state of saccular hair cells. Further, we will discuss the crossing of the bifurcation, and the sensitivity of the phase-locked response in various frequency regimes.

Dolores Bozovic
UCLA

Date submitted: 29 Nov 2010 Electronic form version 1.4