Abstract Submitted
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Phase-locked spiking and stochastic resonance of hair cells[1] ROY SHLOMOVITZ, University of Washington, YUTTANA ROONGTHUMSKUL, SEUNG JI, DOLORES BOZOVIC, ROBIJN BRUINSMA, University of California, Los Angeles — The inner ear constitutes a remarkably sensitive mechanical detector. This detection occurs in a noisy and highly viscous environment, as the sensory cells - the hair cells - are immersed in a fluid-filled compartment and operate at room temperature or higher. We model the active motility of hair cell bundles of the vestibular system with the Adler equation, which describes the phase degree of freedom of bundle motion. We explore both analytically and numerically the response of the system to external signals, in the presence of white noise. The theoretical model predicts that hair bundles poised in the quiescent regime can exhibit sporadic spikes - sudden excursions in the position of the bundle. In this spiking regime, the system exhibits stochastic resonance, with the spiking rate peaking at an optimal level of noise. Upon the application of a very weak signal, the spikes occur at a preferential phase of the stimulus cycle. We compare the theoretical predictions of our model to experimental measurements obtained *in vitro* from individual hair cells. Finally, we show that an array of uncoupled hair cells could provide a sensitive detector that encodes the frequency of the applied signal.

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Roy Shlomovitz
University of Washington

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