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Interaction of mechanical and electrical oscillations and sensitivity in a model of sensory hair cell RAMI M. AMRO, ALEXANDER B. NEIMAN, Department of Physics and Astronomy/Ohio University — Sensory hair cells are the first stage in conveying the mechanical stimuli into the electrical signals in auditory and vestibular organs of vertebrates. Experiments showed that hair cells rely on active processes in hair bundles to achieve high selective sensitivity, e.g. due to myosin molecular motors inside stereocilia. In lower vertebrates these active processes result in spontaneous oscillations of hair bundles which can be accompanied by oscillations of the cells' membrane potentials. We use modeling to study how the dynamics of both the membrane potential and the hair bundle interact to produce coherent self-sustained oscillations and how this interaction contributes to the cell's sensitivity to external mechanical perturbations. The model incorporates a mechanical stochastic hair bundle system coupled to a Hodgkin-Huxley type system for the membrane potential. We show that oscillatory regimes result in enhanced sensitivity and selectivity to harmonic stimuli.

Rami Amro
Department of Physics and Astronomy/Ohio University

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