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Evidence for a Border-Collision Bifurcation in Paced Cardiac Tissue CAROLYN BERGER, HANA DOBROVOLNY, DAVID G. SCHAEFFER, WANDA KRASSOWSKA, DANIEL J. GAUTHIER, Duke University — Bifurcations in the electrical response of cardiac tissue can destabilize spatial-temporal waves of electrical activity in the heart, leading to tachycardia or even fibrillation. Therefore, it is important to characterize the types of bifurcations occurring in cardiac tissue. Our goal is to classify the bifurcation that occurs in cardiac cells when a change in pacing rate induces a transition from 1:1 to 2:2 phase-locked behavior. Current mathematical models predict that the bifurcation mediating the transition is a supercritical pitchfork type. For such a bifurcation, small random noise is predicted to be amplified by greater amounts as the bifurcation is approached (Weisenfeld). However, our experimental observations of paced bullfrog myocardium driven by small beat-to-beat alternations in the pacing rate (rather than driven by noise) displays de-amplification as the bifurcation is approached. To explain this surprising result, we hypothesize that the transition to 2:2 behavior is mediated by border-collision bifurcation, which is predicted to show little noise amplification.
Wiesenfeld, K. Phys. Rev. A **32**, 1744 (1985).

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