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Inferring cardiac phase response curve in vivo ARKADY PIKOVSKY, Department of Physics, University of Potsdam, Germany, BJOERN KRALEMANN, University of Kiel, Germany, MATTHIAS FRUEHWIRTH, Human Research Institute, Weiz, Austria, MICHAEL ROSENBLUM, Department of Physics, University of Potsdam, Germany, THOMAS KENNER, Medical University Craz, Austria, JOCHEN SCHAEFER, Institute for Theoretical Cardiology, Kiel, Germany, MAXIMILIAN MOSER, Human Research Institute, Weiz, Austria — Characterizing properties of biological oscillators with phase response cirves (PRC) is one of main theoretical tools in neuroscience, cardio-respiratory physiology, and chronobiology. We present a technique that allows the extraction of the PRC from a non-invasive observation of a system consisting of two interacting oscillators, in this case heartbeat and respiration, in its natural environment and under free-running conditions. We use this method to obtain the phase coupling functions describing cardio-respiratory interactions and the phase response curve of 17 healthy humans. We show at which phase the cardiac beat is susceptible to respiratory drive and extract the respiratory-related component of heart rate variability. This non-invasive method of bivariate data analysis for the determination of phase response curves of coupled oscillators may find application in other biological and physical systems.

Arkady Pikovsky
Department of Physics, University of Potsdam, Germany

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