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Circadian rhythms and fractal fluctuations in forearm motion KUN HU, PLAMEN CH IVANOV, ZHI CHEN, H. EUGENE STANLEY, Boston University, MICHAEL F. HILTON, STEVEN A. SHEA, Harvard Medical School, CENTER FOR POLYMER STUDIES TEAM — Recent studies have shown that the circadian pacemaker — an internal body clock located in the brain which is normally synchronized with the sleep/wake behavioral cycles — influences key physiologic functions such as the body temperature, hormone secretion and heart rate. Surprisingly, no previous studies have investigated whether the circadian pacemaker impacts human motor activity — a fundamental physiologic function. We investigate high-frequency actigraph recordings of forearm motion from a group of young and healthy subjects during a forced desynchrony protocol which allows to decouple the sleep/wake cycles from the endogenous circadian cycle while controlling scheduled behaviors. We investigate both static properties (mean value, standard deviation), dynamical characteristics (long-range correlations), and nonlinear features (magnitude and Fourier-phase correlations) in the fluctuations of forearm acceleration across different circadian phases. We demonstrate that while the static properties exhibit significant circadian rhythms with a broad peak in the afternoon, the dynamical and nonlinear characteristics remain invariant with circadian phase. This finding suggests an intrinsic multi-scale dynamic regulation of forearm motion the mechanism of which is not influenced by the circadian pacemaker, thus suggesting that increased cardiac risk in the early morning hours is not related to circadian-mediated influences on motor activity.

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