Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Levels of complexity in scale-invariant neural signals[1] PLAMEN CH. IVANOV, Harvard Medical School and Division of Sleep Medicine, Brigham and Womens Hospital, Boston, MA 02115, USA, QIANLI D.Y. MA, Nanjing University of Posts and Telecommunications, Nanjing 210003, China, RONNY P. BARTSCH, Harvard Medical School and Division of Sleep Medicine, Brigham and Womens Hospital, Boston, MA 02115, USA — Many physiological systems exhibit complex scale-invariant and nonlinear features characterized long-range power-law correlations, indicating a possibly common control mechanism. It has been suggested that dynamical processes, influenced by inputs and feedback on multiple time scales, may be sufficient to give rise to this complexity. Two examples of physiologic signals that are the output of hierarchical multiscale physiologic systems under neural control are the human heartbeat and human gait. We show that while both cardiac interbeat interval and gait interstride interval time series under healthy conditions have comparable scale-invariant behavior, they still belong to different complexity classes. We compare results from empirical findings and stochastic feedback modeling approaches to cardiac and locomotor dynamics, which provide new insights into the multicomponent neural mechanisms regulating these complex systems.

[1]Supported by: NIH Grant 1R01HL098437-01A1, Office of Naval Research Grant 000141010078, Brigham and Womens Hospital BRI Fund and the German Academic Exchange Service (DAAD).

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Date submitted: 29 Nov 2011 Electronic form version 1.4