



## CURRICULUM VITAE

### PLAMEN CHRISTOV IVANOV

Associate Professor, D.Sc.

Institute of Solid State Physics, Bulgarian Academy of Sciences,  
Sofia, Bulgaria

Lecturer, Division of Sleep Medicine, Harvard Medical School,  
Harvard, USA

**Linguistic ability:** English, German, Russian

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**Birth date and place:** September 20, 1962, Sofia, Bulgaria

#### Education:

Ph.D. Theoretical Physics/Biophysics, Boston University, USA, 1998

M.S. International Relations, Sofia University, Bulgaria, 1990

M.S. Theoretical Physics/Condensed Matter Physics, Sofia University, Bulgaria, 1988

#### Training:

1998 – 1999 Postdoctoral Fellow, Harvard Medical School, Beth Israel Deaconess Medical Center, Laboratory for Nonlinear Dynamics in Medicine.

1996 – 1998 Research Assistant, Center for Polymer Studies, Boston University.

1993 – 1996 Teaching Assistant, Physics Department, Boston University.

1991 – 1993 Teaching Assistant, Physics Department, University of Rhode Island.

1989 – 1991 Research Assistant, Institute of Solid State Physics, Bulgarian Academy of Sciences.

#### Licensure and Certification:

2007 Doctor of Science (D.Sc.) in Physics, Bulgarian Academy of Sciences.

2002 Habilitation, Statistical/Computational Physics Applied to Physiology, Bulgarian Academy of Sciences.

#### Academic Appointments:

2006 – present Lecturer, Division of Sleep Medicine, Harvard Medical School.

2003 – present Associate Professor, Institute of Solid State Physics, Bulgarian Academy of Sciences.

1999 – present Senior Research Associate, Center for Polymer Studies, Boston University.

#### Hospital or Affiliated Institution Appointments:

2006 – present Associate Physiologist, Brigham and Womens Hospital, Harvard Medical School.

1999 – 2003 Research Associate, Harvard Medical School, Beth Israel Deaconess Medical Center, Margaret and H.A. Rey Laboratory for Nonlinear Dynamics in Medicine.

#### Editorial Boards:

2004 – present Editor of Journal of Biological Physics (JOBP)

2000 – 2002 Editor of Fluctuation and Noise Letters (FNL)

#### Reviewer for Funding Agencies:

2007 – present Israel Science Foundation (ISF).

2004 – present Hungarian Scientific Research Fund (OTKA), Hungarian Academy of Sciences.



**Reviewer for 30 scientific peer-review journals, including:**

Physical Review Letters, Europhysics Letters, Proceedings of the National Academy of Sciences of USA (PNAS), Journal of Theoretical Biology, European Biophysics Journal, IEEE – Transactions of Biomedical Engineering, Fractals, Chaos, Complexity Journal, Circulation, Heart and Circulatory Physiology, Gene, Medical Physics, Journal of Applied Physiology.

**Advisees/Trainees:**

5 post-doctoral fellows; 8 PhD students.

**Educational Leadership Role:**

Founding Member of Physionet, a Research Resource for Complex Physiologic Signals, 1999 (Physionet – [www.physionet.org](http://www.physionet.org)).

**Major Committee Assignments:**

1. Program Committed Member:

- Conference on "Fluctuations and Noise in Biological, Biophysical, and Biomedical Systems", 1-4 June 2003, Santa Fe, New Mexico, USA.
- SPIE 2004 Second International Symposium on Fluctuations and Noise: Conference on "Fluctuations and Noise in Biological, Biophysical, and Biomedical Systems", 26-28 May 2004, Canary Islands, Spain.
- SPIE 2005 Third International Symposium on Fluctuations and Noise: Conference on "Fluctuations and Noise in Biological, Biophysical, and Biomedical Systems", Austin, Texas, 2005.
- SPIE International Symposium on Microelectronics, MEMS and Nanotechnology: Complex Systems I, 12-15 Dec 2005, Brisbane, Australia.
- SPIE International Symposium on Microelectronics, MEMS, Nanotechnology and Biological Systems: Complex Systems II, 4-7 Dec 2007, The Australian National University, Canberra, Australia.

3. Organizer of a Symposium and a Focused Session:

- "Statistical Physics Approaches to Physiology under Health and Disease", American Physical Society March Meeting, Montreal, 2004.

4. International advisory committee member:

- "The Tenth International Symposium on Motor Control", 25-27 September 2004, Sofia, Bulgaria.

5. Proposed, organized and chaired a Symposium:

- "Multiscale Aspects and Dynamical Networks in Integrated Physiologic Systems", American Physical Society March Meeting, Los Angeles, CA, 2005.

6. Organized and chaired Special Conference Sessions on:

- "Physics in Physiology", 6th International Conference on Complex Systems (ICCS2006), Marriott Boston Quincy, Boston, MA, USA, June 25-30, 2006.

**Number of publications:**

90 total, including 3 in Nature, 3 in PNAS, 7 in Physical Review Letters.

Publications in peer-reviewed journals: 69

Book chapters: 5

Total number of citations: 2100

Conference proceedings: 16

Hirsch Factor: **22**

**Media and Press Reviews featuring research activities: 25 total, including:**

Nature Science Update, Scientific American, Nature Research Highlights, New Scientist, Science News, Physical Review Focus, Washington Post, Sueddeutsche Zeitung.

**Selected list of publications:**

1. Ivanov P.Ch., M.G. Rosenblum, C-K Peng, J. Mietus, S. Havlin, H.E. Stanley, A.L. Goldberger (1996). Scaling behaviour of heartbeat intervals obtained by wavelet-based time-series analysis. *Nature*, 383, 323-327.
2. Ivanov P.Ch., L.A.N. Amaral, A.L. Goldberger, H. E. Stanley (1998). Stochastic feedback and the regulation of biological rhythms. *Europhysics Letters*, 43, 363-368.
3. Amaral L.A.N., A.L. Goldberger, P.Ch. Ivanov, H. E. Stanley (1998). Scale-independent measures and pathologic cardiac dynamics. *Physical Review Letters*, 81, 2388-2391.
4. Ivanov P.Ch., M.G. Rosenblum, L.A.N. Amaral, Z.R. Struzik, S. Havlin, A.L. Goldberger, H.E. Stanley (1999). Multifractality in human heartbeat dynamics. *Nature*, 399, 461-465.
5. Ivanov P.Ch., A. Bunde, L.A.N. Amaral, S. Havlin, J. Fritsch-Yelle, R.M. Baevsky, H.E. Stanley, A.L. Goldberger (1999). Sleep-wake differences in scaling behavior of the human heartbeat: analysis of terrestrial and long-term space flight data. *Europhysics Letters*, 48, 594-600.
6. Goldberger A.L., L.A.N. Amaral, L. Glass, J.M. Hausdorff, P.Ch. Ivanov, R.G. Mark, J.E. Mietus, G.B. Moody, C.-K. Peng, H.E. Stanley (2000). PhysioBank, PhysioToolkit, and PhysioNet: components of a new research resource for complex physiologic signals. *Circulation*, 101, e215.
7. Ashkenazy Y., P.Ch. Ivanov, S. Havlin, C.-K. Peng, A.L. Goldberger, H.E. Stanley (2001). Magnitude and sign correlations in heartbeat fluctuations. *Physical Review Letters*, 86(9), 1900-1903.
8. Schulte-Frohlinde V., Y. Ashkenazy, P.Ch. Ivanov, L. Glass, A.L. Goldberger, H.E. Stanley (2001). Noise effects on the complex patterns of abnormal heartbeats. *Physical Review Letters*, 87(6), 068104(4).
9. Ivanov P.Ch., L.A.N. Amaral, A.L. Goldberger, S. Havlin, M.G. Rosenblum, H.E. Stanley, Z. Struzik (2001). From  $1/f$  Noise to Multifractal Cascades in Heartbeat Dynamics. *Chaos*, 11(3), 641-652.
10. Bernaola-Galvan P., P.Ch. Ivanov, L.A.N. Amaral, H.E. Stanley (2001). Scale Invariance in the Nonstationarity of Human Heart Rate. *Physical Review Letters*, 87(16), 168105(4).
11. Carpena P., P. Bernaola-Galvan, P.Ch. Ivanov, H.E. Stanley (2002). Metal-insulator transition in chains with correlated disorder. *Nature*, 418, 955-959.
12. Carpena P., P. Bernaola-Galvan, P.Ch. Ivanov (2004). New class of level statistics in atomic chains with correlated disorder. *Physical Review Letters*, 93(17), 176804(4).
13. Lo C.-C., T. Chou, T. Penzel, T. Scammell, R.E. Strecker, H.E. Stanley, P.Ch. Ivanov (2004). Common scale-invariant patterns of sleep-wake transitions across mammalian species. *Proc. Natl. Acad. Sci.*, 101(52), 17545-17548.
14. Hu K., P.Ch. Ivanov, M.F. Hilton, Z. Chen, R.T. Ayers, H.E. Stanley, S.A. Shea (2004). Endogenous circadian rhythm in an index of cardiac vulnerability independent of changes in behavior. *Proc. Natl. Acad. Sci.*, 101(52), 18223-18227.
15. M.A. de la Casa, F.J. de la Rubia, P.Ch. Ivanov (2007). Patterns of spiral wave attenuation by low-frequency periodic planar fronts. *Chaos*, 17(1), 015109(8).

**Book Chapters and Reviews:**

1. Ivanov P.Ch., A.L. Goldberger, S. Havlin, C.-K Peng, M. G. Rosenblum, H. E. Stanley. *Wavelets in Medicine and Physiology*, – In: *Wavelets in Physics*, J.C. van den Berg (Ed.), Cambridge University Press, Cambridge, 1998.
2. Ivanov P.Ch., A.L. Goldberger, H.E. Stanley. *Fractal and Multifractal Approaches in Physiology*, – In: *The Science of Disasters: Climate Disruptions, Heart Attacks, and Market Crashes*, A. Bunde, J. Kropp and H.-J. Schellnhuber (Eds.), Springer Verlag, Berlin, 2002, 219-257.



3. Ivanov P.Ch., C.C. Lo. Stochastic Approaches to Modeling of Physiological Rhythms, – In: Modelling Biomedical Signals, G. Nardulli and S. Stramaglia (Eds.), World Scientific, Singapore, 2002, 28-50.
4. Ivanov P.Ch. Long-Range Dependence in Heartbeat Dynamics, – In: Processes with Long-Range Correlations: Theory and Applications, Lecture Notes in Physics, vol. 621, G. Rangarajan and M. Ding (Eds.), Springer Verlag, Berlin, 2003, 339-368.
5. Ivanov P.Ch. Random Walks in Physiologic Dynamics, – In: Advances in Condensed Matter and Statistical Physics, E. Korutcheva and R. Cuerno (Eds.), Nova Science Publishers, New York, 2004, 155-175.

**Invited lectures and presentations (USA) -- 22 total.**

**Invited Presentations (International outside USA) -- 42 total.**

**Main Directions of Scientific Research Activities:**

1. Mechanism of cardiac neuroautonomic regulation and interactions with the neuronal regulation of respiration, locomotion and the circadian body clock. Developing methods to quantify the dynamical outputs of these systems.
2. Neuronal basis of sleep stage transitions. How do cerebral networks of sleep-promoting and wake-promoting neural cells interact in order to "switch" on and off rhythmically to account for transitions between specific sleep or wake stages. Modeling the dynamics of these neuronal interactions. Investigating the effects of sleep regulation on cardiac dynamics and other physiological functions.
3. Networks of interaction and synchronization between neural groups and centers in the brain. Adapting concepts from random networks and graph theory, as well as empirical observations, to understand the topology and structure of these dynamical networks.
4. Excitable media. Mechanisms of interaction between periodic fronts and nonlinear spiral waves leading to structured patterns or irregular chaotic behavior. Applications to excitable waves in the myocardium.
5. Long-range electron transport and energy-level structure in low-dimensional disordered systems with long-range spatial correlations. These investigations aim to understand the mechanical and conduction properties of biological macromolecules such as DNA, where differences in the conduction properties of coding and non-coding segments may have importance in the processes of transcription and mutation repair.