한국 물리학회 회보

2014년 가을학술논문발표회 및 임시총회

김대중컨벤션센터
2014. 10. 22(수)~24(금)

후원 광주관광컨벤션뷰로
GWANGJU CONVENTION & VISITORS BUREAU

KPS 한국물리학회
The Korean Physical Society

SESSION F 통계물리학분과회

2014년 10월 22일(수) 통계물리학분과회 구두 발표

[FG1] 통계물리학분과회 General Session: 통계역학
2014년 10월 22일 수요일 13:00 – 14:30 장소: 212/213호
좌장: 권 철 안 명지대

FG-01 [13:00-13:15]
Heat transistor behavior of harmonic chain / 김상락(경기대.)

FG-02 [13:15-13:30]
Total Cost of Operating an Information Engine / UM Jaegon, HINRICHSEN Haye[1], KWON Chulan[2], PARK Hyunggyu(KIAS. [1]University of Wuerzburg. [2]Myongji University.)

FG-03* [13:30-13:45]
Optimal Tuning of Information Engine via Harmonic Potential / PARK Jong-Min, LEE Jae Sung[1], NOH Jae Dong(Department of Physics, University of Seoul. [1]School of Physics, Korea Institute for Advanced Study.)

FG-04 [13:45-14:00]
Voter model on a coevolving network / YI Su Do, BAEK Seung Ki, KIM Beom Jun[1](Department of Physics, Pukyong National University. [1]Department of Physics, Sungkyunkwan University.)

FG-05 [14:00-14:15]
Bursty dynamics and its effect on spreading / 조항현(POSTECH 물리학과.)

FG-06* [14:15-14:30]
Various transition natures in heterogeneous core contact process / 채희승, 육순형, 김엽(경희대학교.)

[FG2] 통계물리학분과회 General Session: 복잡계
2014년 10월 22일 수요일 15:00 – 16:30 장소: 212/213호
좌장: 이 남 경 세종대

FG-07(초) [15:00-15:30]
Anomalous Diffusion of Single-molecules in Living Cells: at the Interface of Biology and Statistical Physics / 전재형(School of Physics, Korea Institute for Advanced Science.)

FG-08 [15:30-15:45]
Chemotaxing and haptotaxing random walkers having directional persistence / 이경진, 권태구(고려대학교 물리학과.)

FG-09 [15:45-16:00]
Matchmaker, Matchmaker, Make Me a Match: Migration of Populations via Marriages in the Past / LEE Sang Hoon, FFRANCON Robyn[1], ABRAMS Daniel[2], KIM Beom Jun[3], PORTER Mason[4](Department of Energy Science, Sungkyunkwan University. [1]Department of Physics, University of Gothenburg. [2]Department of Engineering Sciences and Applied Mathematics, Northwestern University. [3]Department of Physics, Sungkyunkwan University. [4]Mathematical Institute, University of Oxford.)

FG-10 [16:00-16:15]
Traveling-wave solution of evolutionary dynamics in a one-dimensional trait space / LEE Mi Jin, KIM Beom Jun, BAEK Seung Ki[1](Department of physics, Sungkyunkwan University. [1]Department of physics, Pukyong National University.)

FG-11 [16:15-16:30]
Preferential game engagement based on the reputation in prisoners' dilemma game / 박혜진, 정형채, 김범준(성균관대학교 물리학과. [1]세종대학교 물리학과.)

통계물리학분과회 분과총회
2014년 10월 22일 수요일 16:30 – 17:00 장소: 212/213호

2014년 10월 23일(목) 통계물리학분과회 구두 발표

[FG3] 통계물리학분과회 General Session: 생물물리
2014년 10월 23일 목요일 09:00 – 10:45 장소: 212/213호
좌장: 황 동 욱 수리과학연

FG-12 [09:00-09:15]
Transformation of microtubules into inverted tubulin tubules triggered by a tubulin conformation switch / 최명철(KAIST.)

FG-13 [09:15-09:30]
Global and Modular Sparse Synchronization in Small-World Clustered Networks of Inhibitory Fast Spiking Izhikevich Interneurons / LIM Woochang, KIM Sang-Yoon(Daegu National University of Education, Department of Science Education, Computational Neuroscience Lab.)

Effect of Inter-Modular Connection on Fast Sparse Synchronization in Clustered Small-World Neural Networks

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Abstract

We consider a clustered network with small-world sub-networks of inhibitory fast spiking Izhikevich interneurons, and investigate the effect of inter-modular connection on emergence of fast sparsely synchronized rhythms by varying both the inter-modular coupling strength J_{inter} and the average number of inter-modular links per interneuron $M_{syn}^{(inter)}$. In contrast to the case of non-modular networks, two kinds of sparsely synchronized states such as modular and global synchronization are found. For the case of modular sparse synchronization the population behavior reveals the clustering structure, because the intra-modular dynamics of sub-networks make some mismatching. On the other hand, in the case of global sparse synchronization, the population behavior is globally identical, independently of the cluster structure, because intra-modular dynamics of sub-networks make perfect matching. We use a realistic cross-correlation modularity measure, representing the matching-degree between the instantaneous sub-population spike rates of the sub-networks, and examine whether the sparse synchronization is global or modular. Depending on its magnitude, the inter-modular coupling strength J_{inter} seems to play "dual" roles for the pacing between spikes in each sub-network. For large J_{inter}, due to strong inhibition it plays a destructive role to "spoil" the pacing between sparse spikes, while for small J_{inter} it plays a constructive role to "favor" the pacing between spikes. Through competition between the constructive and destructive roles of J_{inter}, there exists an intermediate optimal J_{inter} at which the pacing degree between spikes becomes maximal. In contrast, the average number of inter-modular links per interneuron $M_{syn}^{(inter)}$ seems to play a role just to "favor" global communication between sub-networks. With increasing $M_{syn}^{(inter)}$, the degree of effectiveness of global communication increases monotonically. Furthermore, we employ the realistic whole- and sub-population order parameters, based on the instantaneous whole- and sub-population spike rates, to determine the threshold values for the synchronization-unsynchronization transition in the whole- and sub-populations, and the degrees of the global and modular synchronization are also measured in terms of the realistic statistical-mechanical whole- and sub-population spiking measures defined by considering both the occupation and the pacing degrees of the spikes. It is expected that our results have important implications for the role of the brain plasticity which refers to the brain's ability to change its structure and function by modifying the strength or efficacy of synaptic transmission.