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한국물리학회 회보

2018년 봄 학술논문발표회

및 제94회 정기총회

2018 KPS Spring Meeting

2018년 4월 25일(수) - 27일(금)

대전컨벤션센터



E [E9-co] Pioneer: Computational Approaches to Strongly Correlated Electrons: Models and Materials I

2018. 04. 26 Thursday 14:00~15:48

Room: 201

좌장 : 한명준 한국과학기술원

Chair : HAN Myung Joon (KAIST)

E9.01 [14:00 - 14:24]

Emergent Spacetime Supersymmetry at Superconducting Quantum Criticality of a Single Dirac Cone / YAO Hong^{*1} (Institute for Advanced Study, Tsinghua University)

E9.02 [14:24 - 14:48]

Numerical Investigation of trimer correlations in two and one dimensions / 한정훈^{*1} (성균관대학교 물리학과)

E9.03 [14:48 - 15:12]

Revealing fermionic quantum criticality from new Monte Carlo techniques / MENG Zi Yang^{*1} (Institute of Physics, Chinese Academy of Sciences)

E9.04 [15:12 - 15:36]

Role of Hund's coupling in spin-orbit entangled ground states / GO Ara^{*1} (Center for Theoretical Physics of Complex Systems, Institute for Basic Science)

[E10-st] Biophysics and Granular Systems

2018. 04. 26 Thursday 14:00~15:48

Room: 202

좌장 : 김재업 울산과학기술원

Chair : KIM Jae Up (UNIST)

E10.01 [14:00 - 14:24]

Theory for selective cargo transport through the nuclear pore complex: Interactive diffusion over fluctuating polymer barrier / 김용운^{*1} (한국과학기술원 나노과학기술대학원)

E10.02 [14:24 - 14:36]

Fast sparsely synchronized rhythms in a small-world neuronal network with inhibitory spike-timing-dependent plasticity / KIM Sang-Yoon¹, LIM Woochang^{*1} (Institute for Computational Neuroscience and Department of Science Education, Daegu National University of Education)

E10.03 [14:36 - 14:48]

Encoding information into autonomously bursting neural network with pairs of two time-delayed pulses / 이경진¹, 김준환¹, 이호준¹ (고려대학교 물리학과)

E10.04 [14:48 - 15:00]

How the nose is optimized: statistical design principles of human olfactory receptors / BAK Ji Hyun^{*1} (School of Computational Sciences, KIAS)

E10.05 [15:00 - 15:12]

자기조직화하여 민감도를 증강시키는 청각 유모세포 시냅스 소포 / 안강현^{*1} (충남대학교 물리학과)

E10.06 [15:12 - 15:24]

Neural field theory of Parkinson's disease and generalized epilepsies / 김종원^{*1} (인제대학교 헬스케어 IT)

E10.07 [15:24 - 15:36]

How randomly distributed attractive particles evolve in 1D: Defects of liquid crystals in capillaries / ALMUKAMBETOVA Madina¹, JAVADI Arman¹, JEONG Joonwoo^{*1} (Department of Physics, UNIST)

[E11-or] 물리학 전공 인력의 진로 현황(Career Search for Physics-majors in Our Society)

2018. 04. 26 Thursday 14:00~15:48

Room: 204

좌장 : 김윤기 광운대학교

Chair : KIM Yunki (Kwangwoon University)

E11.01 [14:00 - 14:48]

자연계열 전공자 노동시장 이행 성과 및 경쟁력 확보 방안 / 심정민^{*1} (한국과학기술기획평가원)

Fast sparsely synchronized rhythms in a small-world neuronal network with inhibitory spike-timing-dependent plasticity

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Abstract:

We consider the Watts-Strogatz small-world network (SWN) consisting of inhibitory fast spiking Izhikevich interneurons. This inhibitory neuronal population has adaptive dynamic synaptic strengths governed by the inhibitory spike-timing-dependent plasticity (iSTDP). In previous works without iSTDP, fast sparsely synchronized rhythms, associated with diverse cognitive functions, were found to appear in a range of large noise intensities for fixed strong synaptic inhibition strengths. Here, we investigate the effect of iSTDP on fast sparse synchronization (FSS) by varying the noise intensity D . We employ an asymmetric anti-Hebbian time window for the iSTDP update rule [which is in contrast to the Hebbian time window for the excitatory STDP (eSTDP)]. Depending on values of D , population-averaged values of saturated synaptic inhibition strengths are potentiated [long-term potentiation (LTP)] or depressed [long-term depression (LTD)] in comparison with the initial mean value, and dispersions from the mean values of LTP/LTD are much increased when compared with the initial dispersion, independently of D . In most cases of LTD where the effect of mean LTD is dominant in comparison with the effect of dispersion, good FSS (with higher spiking measure) is found to get better via LTD, while bad FSS (with lower spiking measure) is found to get worse via LTP. This kind of Matthew effect in inhibitory synaptic plasticity is in contrast to that in excitatory synaptic plasticity where good (bad) synchronization gets better (worse) via LTP (LTD). Emergences of LTD and LTP of synaptic inhibition strengths are intensively investigated via a microscopic method based on the distributions of time delays between the pre- and the post-synaptic spike times. Furthermore, we also investigate the effects of network architecture on FSS by changing the rewiring probability P of the SWN in the presence of iSTDP.

Keywords:

Inhibitory spike-timing-dependent plasticity, Fast sparsely synchronized rhythm, Watts-Strogatz small-world network