

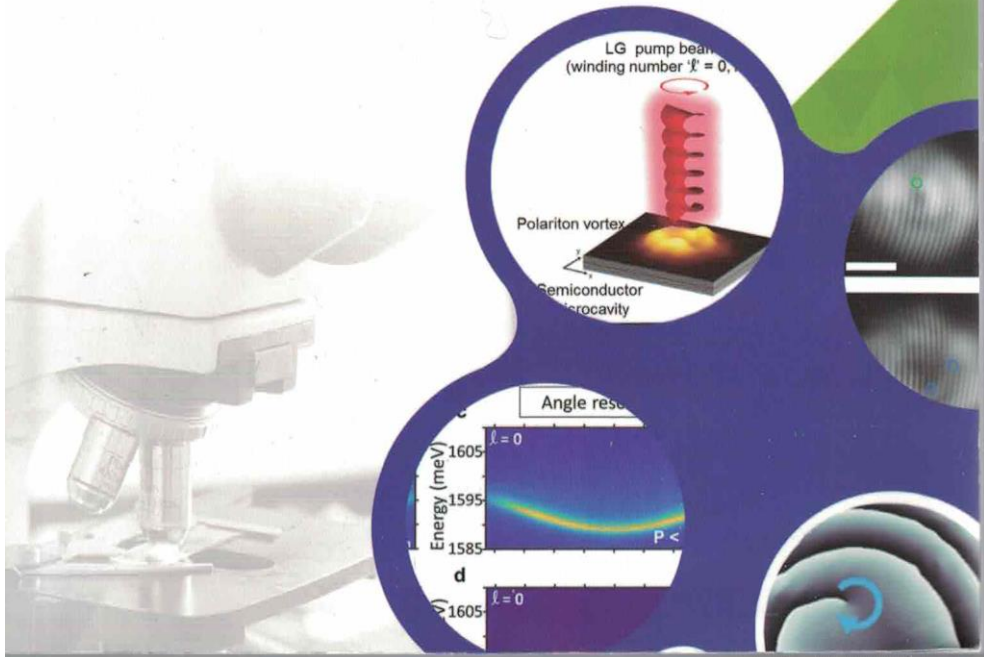
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# 2019년 봄 학술논문발표회 및 제95회 정기총회

## 2019 KPS Spring Meeting

2019년 4월 24일(수) - 26일(금)  
대전컨벤션센터



**[I10-st] Biophysics**

2019. 04. 26 Friday 11:00-12:12

Room: 202

좌장 : 김범준 성균관대학교

Chair : KIM Beom Jun (Sungkyunkwan University)

**I10.01** [11:00 - 11:24]

어느 방향에서 소리가 들리는가를 인간의 귀는 어떻게 인식하는가? / 안강현<sup>1</sup> (충남대학교 물리학과)

**I10.02\*** [11:24 - 11:36]

딤러닝 오토 인코더와 오디오 빔포밍 기법을 이용한 인간 두귀 청각 모델 구현 / 박상현<sup>1</sup>, 안강현<sup>1</sup> (충남대학교 물리학과)

**I10.03** [11:36 - 11:48]

**Effect of Interpopulation Spike-Timing-Dependent Plasticity on Synchronized Rhythms in Neuronal Networks with Inhibitory and Excitatory Populations /** KIM Sang-Yoon<sup>1</sup>, LIM Woochang<sup>1</sup> (Institute for Computational Neuroscience and Department of Science Education, Daegu National University of Education)

**I10.04** [11:48 - 12:00]

**A first-passage approach to the thermal breakage of a discrete one-dimensional chain /** BENETATOS Panayotis<sup>1</sup>, RAZBIN Mohammadhosein<sup>2,3</sup>, MOOSAVI-MOVAHEDI Ali Akbar<sup>2</sup> (경북대학교 물리학과, <sup>2</sup>Institute of Biochemistry and Biophysics, University of Tehran, Iran, <sup>3</sup>Department of Energy Engineering and Physics, Amirkabir University of Technology, Iran)

**I10.05** [12:00 - 12:12]

**Label-free detection of nanoscopic objects using the iSCAT microscopy /** 이일범<sup>1</sup>, 박진성<sup>1</sup>, 문현민<sup>1</sup>, 홍석철<sup>1,2</sup>, 조민행<sup>1,3</sup> (Center for Molecular Spectroscopy and Dynamics, IBS, <sup>2</sup>Department of physics, Korea university, <sup>3</sup>Department of chemistry, Korea university)

**[I11] No session**

# Effect of Interpopulation Spike-Timing-Dependent Plasticity on Synchronized Rhythms in Neuronal Networks with Inhibitory and Excitatory Populations

KIM Sang-Yoon<sup>1</sup>, LIM Woochang\*<sup>1</sup>

<sup>1</sup>Institute for Computational Neuroscience and Department of Science Education, Daegu National University of Education  
wclim@icn.re.kr

## Abstract:

We consider clustered small-world networks (SWNs) with two inhibitory (I) and excitatory (E) populations. This I-E neuronal network has adaptive dynamic I to E and E to I interpopulation synaptic strengths, governed by interpopulation spike-timing-dependent plasticity (STDP) [i.e., I to E inhibitory STDP (iSTDP) and E to I excitatory STDP (eSTDP)]. In previous works without STDPs, fast sparsely synchronized rhythms, related to diverse cognitive functions, were found to appear in a range of noise intensity  $D$  for static synaptic strengths. Here, by varying  $D$ , we investigate the effect of interpopulation STDPs on diverse population and individual properties of synchronized rhythms that emerge in the I- and the E-populations. Depending on values of  $D$ , long-term potentiation (LTP) and long-term depression (LTD) for population-averaged values of saturated interpopulation synaptic strengths are found to occur, and they make effects on the degree of population synchronization. In a broad region of intermediate  $D$ , the degree of good synchronization (with higher spiking measure) becomes decreased, while in a region of large  $D$ , the degree of bad synchronization (with lower spiking measure) gets increased. Consequently, in each I- or E-population, the synchronization degree becomes nearly the same in a wide range of  $D$  (including the intermediate and the large  $D$  regions). This kind of "equalization effect" is found to occur via cooperative interplay between the average occupation and pacing degrees of synchronized rhythms. Furthermore, such equalization effect is much more enhanced in the presence of combined I to E and E to I STDPs when compared with each case of I to E and E to I STDPs. We note that the equalization effect in interpopulation synaptic plasticity is in contrast to the Matthew (bipolarization) effect in intrapopulation (I to I and E to E) synaptic plasticity where good (bad) synchronization gets better (worse). Moreover, emergences of LTD and LTP of interpopulation synaptic strengths are intensively investigated via a microscopic method based on the distributions of time delays between the pre- and the post-synaptic spike times.

## Keywords:

Equalization Effect, Interpopulation Spike-Timing-Dependent Plasticity, Fast Sparsely Synchronized Rhythm