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- 한국물리학회 회보

# 2023년 봄 학술논문발표회 및 제99회 정기총회

2023 KPS Spring Meeting

**일시:** 4월19일(수)~21일(금)

**장소:** 대전컨벤션센터,  
IBS과학문화센터

**[I2-st] Nonlinear Dynamics and Soft Matters**

2023. 04. 21 Friday 11:00~12:24

Room: DCC 102

좌장 : 하미순 조선대학교

Chair: HA Meesoon (Chosun University)

**I2.01** [11:00 - 11:12]

**In-Vivo Firing Activities in A Spiking Neural Network of The Basal Ganglia /** KIM Sang-Yoon<sup>1</sup>, LIM Woochang<sup>1</sup> (<sup>1</sup>Daegu National University of Education)

**I2.02\*** [11:12 - 11:24]

**Effective rate law for biological feedback control /** LIM Roktaek<sup>2</sup>, MARTIN Thomas<sup>2</sup>, CHAE Junghun<sup>1</sup>, KIM WooJoong<sup>1</sup>, KIM HaNeul<sup>1</sup>, GHIM Cheol-Min<sup>1</sup>, KIM Pan-Jun<sup>2</sup> (<sup>1</sup>Department of Physics, UNIST, <sup>2</sup>Department of Biology, Hong Kong Baptist University, Hong Kong)

**I2.03\*** [11:24 - 11:36]

**Bacteria run faster and tumble more at higher temperatures /** KIM Jungmyung<sup>1</sup>, SON Joowang<sup>1</sup>, KIM Jaeup<sup>1</sup>, JEONG Joonwoo<sup>1</sup> (<sup>1</sup>Department of Physics, UNIST)

**I2.04** [11:36 - 11:48]

**Energy transfer dynamics of photosynthesis /** KIM Eunchul<sup>1</sup>, LEE Daekyung<sup>2</sup>, SAKAMOTO Souichi<sup>3</sup>, JO Ju-Yeon<sup>3</sup>, VARGAS-CONTRERAS Mauricio Antonio<sup>4</sup>, ISHIZAKI Akihito<sup>3</sup>, MINAGAWA Jun<sup>1</sup>, KIM Heetae<sup>2</sup> (<sup>1</sup>Division of Environmental Photobiology, National Institute for Basic Biology, Japan, <sup>2</sup>Department of Energy Engineering, Korea Institute of Energy Technology, <sup>3</sup>Institute for Molecular Science, National Institutes of Natural Sciences, Japan, <sup>4</sup>Instituto de Matemáticas, Universidad de Talca, Chile)

**I2.05** [11:48 - 12:00]

**On the central bead of gaussian semiflexible polymers /** XAVIER Durang<sup>1</sup>, JEON Jae-Hyung<sup>1</sup> (<sup>1</sup>Department of Physics, POSTECH)

**I2.06\*** [12:00 - 12:12]

**Transient confinement and recovery dynamics in viscoelastic systems /** LIM Chan<sup>1</sup>, JEON Jae-Hyung<sup>1,2</sup> (<sup>1</sup>Department of Physics, POSTECH, <sup>2</sup>Asia-Pacific Center for Theoretical Physics(APCTP))

**I2.07\*** [12:12 - 12:24]

**Active diffusion of self-propelled particles in flexible or semi-flexible polymer networks /** KIM Yeongjin<sup>1</sup>, JOO Sungmin<sup>1</sup>, KIM Won Kyu<sup>2</sup>, JEON Jae-Hyung<sup>3</sup> (<sup>1</sup>Department of Physics, POSTECH, <sup>2</sup>School of Computational Sciences, KIAS, <sup>3</sup>APCTP)



# In-Vivo Firing Activities in A Spiking Neural Network of The Basal Ganglia

학술대회 명 2023 KPS Spring Meeting | 접수일 2023-02-06

발표분야 Statistical Physics | 서브발표분야 Complex Systems

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

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Presentation materials There is no data.

## Abstract:

The basal ganglia (BG) are group of subcortical nuclei located at the base of the forebrain. The BG exhibit a variety of functions for motor and cognition. We construct a spiking neural network (SNN) for the BG, composed of the striatum (main input nucleus), substantia nigra pars reticulata (SNr: output nucleus), and the intermediate control nuclei [globus pallidus (GP) and subthalamic nucleus (STN)]. Also, spiny projection neurons (SPNs) with D1 and D2 dopamine (DA) receptors constitute a major population of primary inhibitory striatal neurons. We note that DA modulates the BG functions. Here, we consider the effect of DA on the excitability of the D1/D2 SPNs and the synaptic currents. Each single neuron is modeled in terms of the Izhikevich neuron model. We also consider the excitatory and the inhibitory synaptic currents and the random noise input into each BG cell. In our SNN of the BG, we study in-vivo firing activities of the BG cells. In each BG cell, we choose the synaptic parameters (synaptic connection parameters, maximum conductance, synaptic decay and delay time) and the noise intensity to match its physiological firing data. Consequently, BG cells in our SNN exhibit firing activities which are nearly the same as in-vivo (awake resting) physiological data.

## Keywords:

Basal ganglia, In-vivo firing activity