

- 2020. 07 제38권 제1호
- Bulletin of the Korean Physical Society
- 한국물리학회 회보

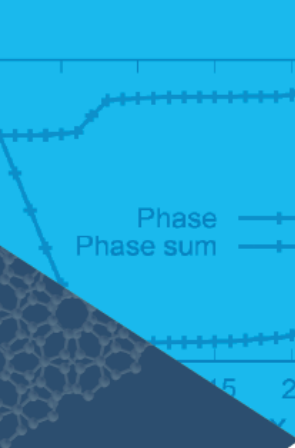
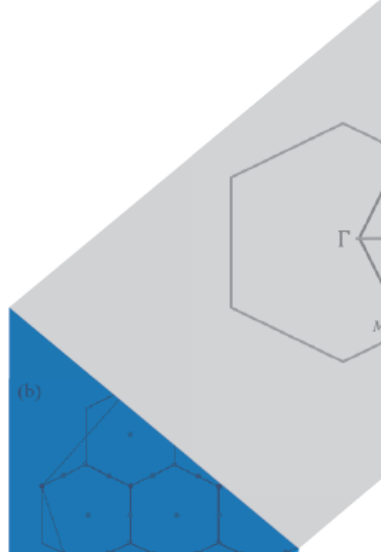
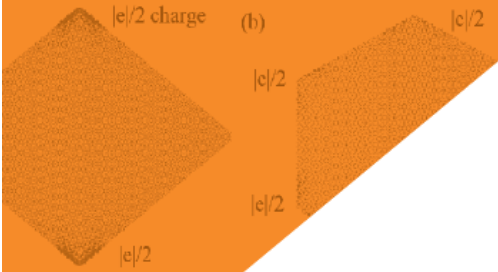
2020년

봄 학술논문발표회 및 제96회 정기총회

2020 KPS Spring Meeting

2020년 7월 13일(월) - 15일(수)

Virtual Conference



- Carbon in the top layer
- Carbon in the bottom layer

D9.04 [09:48 - 10:00]

Prediction of sea level rise and volatility analysis near the Korean Peninsula / KIM Young Jin¹, KWON Okyu¹, SONG Hark-Soo¹, KANG Hyuk*¹ (NIMS)

D9.05 [10:00 - 10:12]

Quantum Attractors and Complex Spacing statistics / THINGNA Juzar Yahya*¹ (PCS, IBS)

D9.06 [10:12 - 10:24]

Effect of Diverse Spiking Patterns of Granule Cells on Optokinetic Response in The Cerebellum / KIM Sang-Yoon¹, LIM Woochang*¹ (Daegu National University Of Education)

D9.07 [10:24 - 10:36]

Glassy dynamics of compressed pulmonary surfactant monolayers / KIM Yeonghoon¹, LIEKKINEN Juho², MARTINEZ-SEARA Hector³, JAVANAINEN Matti³, JEON Jae-Hyung*¹ (Department of Physics, POSTECH, ²Department of Physics, University of Helsinki, ³Institute of Organic Chemistry and Biochemistry, Czech Academy of Sciences)

D9.08 [10:36 - 10:48]

Persistence of harmful intragenomic elements in bacterial populations / PARK Hye Jin*¹, GOKHALE Chaitanya², BERTELS Frederic³ (Statistical physics of ecology and Evolution, APCTP, ²Theory Department, Max Planck Institute for Evolutionary Biology, ³Department Microbial Population Biology, Max Planck Institute for Evolutionary Biology)

[D10-te] Focus: New direction of physics education

2020. 07. 14 Tuesday 09:00~10:12

Room: 10

좌장 : 정용욱 경상대학교 물리교육

Chair : JUNG Yong Woo Kyung Hee Univeristy)

D10.01 [09:00 - 09:24]

딥러닝 및 머신러닝을 활용한 물리교육의 활용 방안 / JHO Hunkoog*¹ (Graduate school of education, Dankook University)

D10.02 [09:24 - 09:48]

물리교육과 텍스트 네트워크 분석 / 윤은정¹, 박윤배*² (경북대학교 과학교육연구소, ²경북대학교 물리교육과)

D10.03 [09:48 - 10:12]

2020 발명교육 현황과 물리교육에의 시사점 / 정용욱*¹, 김민기² (경상대학교 물리교육과, ²한국 발명진흥회)

D

Abstract Submission

Effect of Diverse Spiking Patterns of Granule Cells on Optokinetic Response in The Cerebellum

학술대회명 2020 KPS Spring Meeting

접수일 2020-02-28

발표분야 Statistical physics

서브발표분야 Biophysics(F)

Author KIM Sang-Yoon¹, LIM Woochang¹

Affiliation ¹, Daegu National University Of Education

교신저자 이메일 woochanglim@dnue.ac.kr

Abstract:

We investigate the effect of diverse recoding of granule (GR) cells on optokinetic response in a cerebellar ring network by varying the connection probability P_c from Golgi to GR cells. For an optimal value of P_c^* ($=0.06$), individual GR cells exhibit diverse spiking patterns which are in-phase or out-of-phase with respect to their population-averaged firing activity. Then, these diversely-recoded signals via parallel fibers (PFs) from GR cells are effectively depressed by the error teaching signals via climbing fibers (CFs) from the inferior olive which are also in-phase ones. Synaptic weights at in-phase PF-Purkinje cell (PC) synapses of active GR cells are strongly depressed via strong long-term depression (LTD), while those at out-of-phase PF-PC synapses are weakly depressed through weak LTD. This kind of "effective" depression at PF-PC synapses causes a big modulation in firing of PCs, which then exert effective inhibitory coordination on vestibular nucleus (VN) (which evokes OKR). For the firing of VN neuron, the learning gain degree L_g , corresponding to the modulation gain ratio (i.e., normalized modulation divided by that at the 1st cycle), increases with increasing learning cycle, and it saturates at about the 300th cycle. By varying P_c , we find that a plot of L_g^* versus P_c forms a bell-shaped curve with a peak at P_c^* (where the diversity degree D in firing of GR cells is also maximum). The more diverse in recoding of GR cells, the more effective in motor learning for the eye movement.

Keywords:

Optokinetic response, Cerebellar ring network, Granule cells, Diverse recording, Motor learning