



# Program & Abstracts

48<sup>th</sup> Vietnam Conference on Theoretical Physics

**HỘI NGHỊ VẬT LÝ LÝ THUYẾT VIỆT NAM  
LẦN THỨ 48**



Đà Nẵng

31 July-3 August 2023

- 08:30 - 10:00 P.38 – Poster  
Optical Absorption Coefficient and Refractive-Index Change in Weyl semimetal thin films  
**Huynh V. Phuc** (Dong Thap University)
- 08:30 - 10:00 P.39 – Poster  
Polyacrylonitrile-derived porous carbon nanofiber activated by terephthalic acid as free-standing anodes for lithium-ion batteries  
**Le Dang Manh** (Nguyen Tat Thanh University)
- 08:30 - 10:00 P.40 – Poster  
Identifying inhibitors of NSP16-NSP10 of SARS-CoV-2 from large databases  
**Nguyen Quoc Thai** (Dong Thap University)
- 08:30 - 10:00 P.41 – Poster  
Thermodynamic properties of competing magnetic interaction systems in perspective of Monte Carlo simulation and effective field theory  
**Bach Huong Giang** (VNU University of Science)
- 08:30 - 10:00 P.42 – Poster  
Influence of Kerr nonlinearity on electromagnetically induced grating in a three-level lambda-type atomic system  
**Doai Van Le** (Vinh University)
- 08:30 - 10:00 P.43 – Poster  
Dual-channel Optical bistability in a four-level atomic system with a static magnetic field  
**Luong Thi Yen Nga** (Vinh University)
- 08:30 - 10:00 P.44 – Poster  
Double and triple occupancies in large mass imbalance mixtures  
**Nguyễn Hồng Sơn** (Trường Đại học Công đoàn)
- 08:30 - 10:00 P.45 – Poster  
Electron-phonon correlations inducing excitonic excitations in semimetal and semiconducting materials  
**Do Thi Hong Hai** (Hanoi University of Mining and Geology)
- 08:30 - 10:00 P.46 – Poster  
Excitonic insulator in the mass imbalance extended Falicov–Kimball model  
**Nguyen Thi Hau** (HaNoi University of mining and geology)
- 08:30 - 10:00 P.47 – Poster  
C4N3BN monolayer with persistent half-metallic magnetism  
**Phạm Nam Phong** (Hanoi University of Science and Technology)
- 08:30 - 10:00 P.48 – Poster  
Stationary characteristic quantities of contact interaction particle system in a harmonic trap or an optical lattice at extremely low temperature  
**Pham Nguyen Thanh Vinh** (Ho Chi Minh City University of Education)

(2) *Department of Occupational Safety and Health, Trade Union University, 169 Tay Son, Hanoi, Vietnam*

Optical lattices of dual-species atomic mixtures with large mass imbalance are modelled by an extended three-component Falicov-Kimball model. The dual-species mixtures consist of single-component light and double-component heavy atoms. Due to the large mass imbalance, only the light atoms are moveable across the optical lattice, whereas the heavy atoms are localized at the lattice sites. Both two- and three-body interactions between the atom components are included. The dynamics of light atoms, as well as the double and triple occupancies are determined within the dynamical mean field theory. It is found that the insulating phases can be classified by the double occupancies between the atom components, and they can occur only at certain fillings and strong interaction range. The triple occupancy is finite only in the metallic phase.

**Presenter: Nguyễn Hồng Sơn**

P.45 – Poster, VCTP-48

### **Electron-phonon correlations inducing excitonic excitations in semimetal and semiconducting materials**

*Do Thi Hong Hai (1) and Phan Van Nham (2)*

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The influence of phonons on the low-energy excitonic excitations at zero temperature in the extended Falicov-Kimball model has been investigated. In the framework of the unrestricted Hartree-Fock approximation, a set of self-consistent equations for the excitonic condensate order parameter and a lattice distortion is derived when both electron-phonon coupling and electron-hole Coulomb interaction are treated on an equal footing. The low-energy excitation properties of the excitonic condensate are addressed in signatures of the optical conductivity and the dynamical excitonic susceptibility function. The real part of the optical conductivity is evaluated by the Kubo linear response theory and the imaginary part of the dynamical excitonic susceptibility is found by adapting the random phase approximation. In the semimetal state, one always finds a sharp peak in the optical conductivity spectrum indicating the stability of the excitonic condensation in the BCS type if the correlation between electrons and phonons becomes significant. In contrast, the peak is smeared out on the semiconducting side indicating the stability of the BEC-type excitonic condensate. In this semiconducting side, the sharp peak signature appears and the system turns to the BCS-type excitonic condensation state by increasing the electron-phonon correlations. In either the semimetal or the semiconducting normal state, increasing the electron-phonon correlations always reinforces a low-energy sharp peak in the dynamical excitonic susceptibility spectrum, indicating the existence of the tightly bound excitonic excitations before the condensation state. Specifically, on the semiconducting side, the “halo” phase with the preformed excitons exiting outside of the BEC-excitonic condensation state has been specified. The halo phase becomes more recognizable by raising the electron-phonon correlations.

**Presenter: Do Thi Hong Hai**

P.46 – Poster, VCTP-48

### **Excitonic insulator in the mass imbalance extended Falicov–Kimball model**