26 - 30 June 2023
Belgrade, Serbia

21. СИМПОЗИЈУМ ФИЗИКЕ КОНДЕНЗОВАНЕ МАТЕРИЈЕ

THE 21st SYMPOSIUM ON CONDENSED MATTER PHYSICS

BOOK OF ABSTRACTS

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Vinca Institute of Nuclear Sciences
University of Belgrade, Faculty of Physics
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Ministry of Science, Technological Development and Innovation

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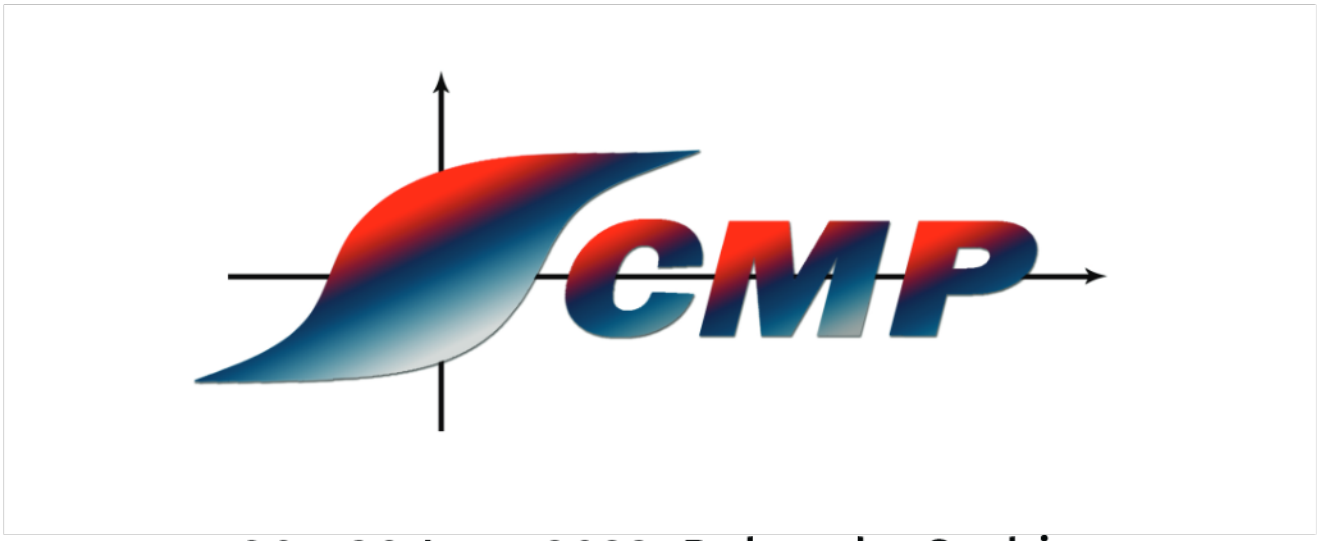

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Exploring Superconductivity In Doped Mono- And Bilayer Borophenes

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Abstract. The boron atom, possessing a profound research background, persists in engrossing the scientific community through its extraordinary and distinguishing chemical properties [1]. During the initial stage of boron exploration, the primary aim entailed comprehending the fundamental characteristics of this lightweight element through meticulous examination of its behavior in various dimensions, primarily encompassing three-dimensional (3D) clusters and the potential formation of two-dimensional (2D) structures [2,3]. Expanding upon previous theoretical predictions [4,5], a significant advancement was achieved in 2015, marked by the synthesis of two-dimensional (2D) boron configurations on a silver substrate, which were subsequently denoted as borophenes [6,7]. This pivotal advancement has enabled a plethora of research endeavors, elucidating the distinctive physical properties inherent in this anisotropic metallic material. These properties include high mechanical flexibility and strength, optical transparency, the existence of Dirac fermions, and the theoretically predicted superconductivity. The diverse array of physical properties exhibited by borophene make it exceptionally well-suited for a wide range of advanced technological applications, encompassing, but not limited to, energy storage, gas sensing, catalysis, and the fabrication of nano-superconducting devices [8, 9]. Nevertheless, the practical utilization of borophene has been hindered due to its susceptibility to oxidation upon contact with air, resulting in the loss of its potentially beneficial functional properties [10]. Significant progress has been achieved in addressing this issue through the synthesis of hydrogenated borophene (borophane) [11] and various polymorphs of bilayer borophene [12,13]. Hydrogenation effectively mitigates the undesired reactivity of borophene, while bilayer structures exhibit reduced susceptibility to oxidation compared to their monolayer counterparts. Drawing inspiration from recent advancements, I will present the advantageous impacts of hydrogenation on the superconducting properties of monolayer borophenes. Additionally, I will explain the role of intercalation in stabilizing and augmenting phonon-mediated superconductivity in bilayer borophenes. The primary objective is to comprehend the superconducting properties exhibited by these structures, which possess stability in ambient conditions (outside the vacuum chamber) and demonstrate minimal chemical reactivity. This renders them highly suitable for the development of advanced nano-superconducting devices.