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## ABSTRACT:

### From 2D to 1D Carbon Allotrope. Two Examples of Recent Advances: Functionalized Graphene and Carbyne Based Polymers

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In this talk, I will present two recent systems we are currently investigating. The first is a novel 2D material: graphene functionalized with ordered intercalated Erbium atoms. This system enables us to achieve unprecedentedly high e-doping levels of graphene, surpassing the Lifshitz transition, the highest electron doping ever achieved through intercalation alone [1]. The doped system exhibits a large flat band at the Fermi level. By studying its magnetic properties, we have identified an antiferromagnetic transition. We will discuss the analogy of this system with heavy fermion alloys, where here, localized 4f electrons from Erbium interact with delocalized  $\pi$ -band electrons in the top graphene layer and show how this interaction can be further tuned through additional graphene functionalization [2]. In a second part I will present the recent synthesis with a host-guest polymerization strategy by supramolecular co-crystallization of 1D nanostructure of polymerized from self-organized diiododiacetylene monomer by topochemistry (formation of Poly(Diiododiacetylenes) (PIDA chains) and our attempts to control its transition to the so-called “allusive” carbyne an infinite chain of alternating single and triple C-bonds [3]. We will report four probe conductivity measurements under a SEM and their correlation with quantitative Raman spectroscopy. We also studied the reactivity of the PIDA with gold surface leading to the formation of long Carbyne chains evidenced by STM.

[1] A. Zaarour et al Physical Review Research 5(1), 013099 (2023)

[2] A. Zaarour et al, in preparation

[3] Y. Zubchuk, et al submitted