Harnessing localized phonon wave resonance in multilayered carbyne-enriched nano-interfaces for efficient conversion of cosmic radiation into electricity

Lukin A N[1,@] **and Gulseren O**[2]

[1] Western-Caucasus Research Center, Tupik Zvezdniy 9, Tuapse, Krasnodar Territory 352808, Russia

[2] Department of Physics, Bilkent University, Bilkent, Ankara 06800, Turkey

[@] lukin@wcrc.ru

This work explores the potential of utilizing localized phonon wave resonance in multilayered carbyne-enriched nano-interfaces for the efficient conversion of cosmic radiation into electricity. Cosmic radiation comprises charged particles that impart kinetic energy, resulting in vibrations upon collision with surrounding materials. By harnessing these vibrations, nanoscale devices akin to piezoelectric materials can convert cosmic radiation into electrical energy. Our proposed concept focuses on the design of specialized multilayered carbyne-enriched nano-interfaces that exhibit resonance or oscillation in response to cosmic radiation vibrations, thereby enhancing the capture and conversion of vibrational energy. By employing ion-assisted pulse-plasma heteroatom doping, these multilayered carbyne-enriched nano-interfaces can function as controllable piezoelectric materials. Integration of these interfaces into piezoelectric nanogenerators enables the conversion of cosmic radiation vibrations into electric current. Our methodology combines advanced fabrication techniques with a targeted data-driven strategy based on the carbon nanomaterial genome approach, enabling unparalleled control over interfacial phonons. The reported study was funded by the Russian Foundation for Basic Research and the Scientific and Technological Research Council of Turkey according to the research project No. 20-58-46014.