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Graphene-based Light Invisible Particle Search (GLIPS)

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We introduce a new dark-matter detection experiment that will enable the search of keV-range super-light dark matter, representing an improvement of the minimum detectable mass by more than three orders of magnitude over the ongoing experiments. This is possible by integrating intimately the target material, π-bond electrons in graphene, into a Josephson junction to achieve a high sensitivity detector that can resolve a small energy exchange from dark matter as low as ˜0.1 meV. We investigate detection prospects with pg-, ng-, and g-scale detectors by calculating the scattering rate between dark matter and the free electrons confined in two-dimensional graphene with Pauli blocking factors included. We find not only that the proposed detector can serve as a complementary probe of super-light dark matter but also achieve higher experimental sensitivities than other proposed experiments, i.e. in having a low detectable threshold provided the same target mass, thanks to the extremely low energy threshold of our graphene-based Josephson junction sensor.

Primary author: Prof. PARK, Jong-Chul (Chungnam National University)

Co-authors: Dr KIM, Doojin (Texas A & M University (US)); Dr FONG, Kin Chung (Raytheon BBN Technologies); Prof. LEE, Gil-Ho (Pohang University of Science and Technology)

Presenter: Prof. PARK, Jong-Chul (Chungnam National University)

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