Discovery of the specific properties of graphite-based carbon materials

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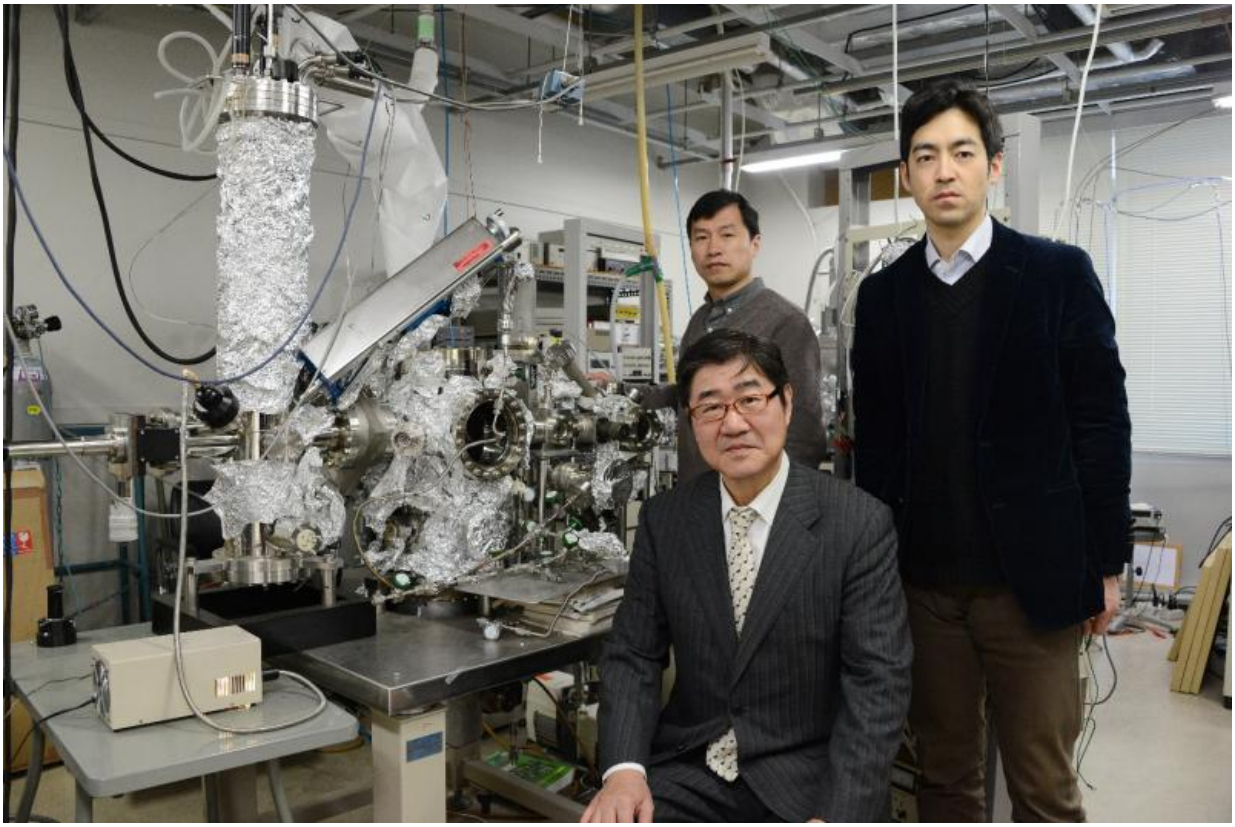

Prof. Junji Nakamura (front), Dr. Donghui Guo (left), Assoc. Prof. Takehiro Kondo (right)

Research collaborators have shown from detailed measurements that in atomically flat areas of a nitrogen-doped graphite surface in the absence

of external magnetic fields, Landau levels manifest corresponding to super strong magnetic fields of approximately 100 tesla across bilayer graphene.

There has been some debate thus far that the source of Landau levels generated under non-magnetic fields has been pseudo-magnetic fields induced by asymmetries, but in this study the researchers observed Landau levels on atomically flat surfaces without asymmetries, showing for the first time the existence of Landau levels generated by sources other than asymmetries. These results further endorse the "domain model" (the mechanism for Landau level generation under a non-magnetic field) that this same research team has advocated for in the past, and newly reveals the unique properties of graphite-based carbon materials such as graphene, which could be used as new materials in electronic devices or for catalysis.

Graphite-based carbon materials such as graphene exhibit powerful electrical conductivity and excellent strength in small quantities, so there is hope that they may contribute to next-generation materials in a variety of fields. The discovery of new physical properties of carbon materials in this study could lead to new applications in environmental materials like electronic materials that make use of electronic state controls such as band gap controls, catalysts or batteries.

More information: Takahiro Kondo et al. Observation of Landau levels on nitrogen-doped flat graphite surfaces without external magnetic fields, *Scientific Reports* (2015). DOI: 10.1038/srep16412

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