Observation of negative refraction in ballistic graphene heterojunctions

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Member of the Korean Physical Society (1987 – present)
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Board member of Korean Superconductivity Society (2001. 2.- 2011.1)
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Conference chair; East Asia Symposium on Superconductor Electronics - EASSE 2005; Gyeongju, Korea.
Organizing committee member; International Symposium on Intrinsic Josephson Effect,
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Key organizer; International Workshop on Interplay between Superconductivity and Magnetism, 2006; Seoul, Korea.
Organizer; APCTP Workshop on Superconductivity and Mesoscopic Quantum Phenomena, 2007; Pohang, Korea.
Conference chair; International Workshop on Electronic Coherence and Correlations, 2007; Pohang, Korea.
Organizing Committee member; East Asia Symposium on Superconductor Electronics-EASSE 2007, 2007; Indian Institute of Technology, Delhi, India.
Conference chair; THz-Plasma 2008; Pohang, Korea.
International Organizing Committee member; THz-Plasma 2010; Hirosaki Univ., Japan.
Conference Organization Committee member, Localisation 2011, 2011; Pohang, Korea.
Conference chair; International Conference in Ultralow Temperatures, 2011; Daejon, Korea.
Conference chair; 2nd International Conference on Recent Progress in Graphene Research, 2011; Suwon, Korea.
International Organizing Committee member; THz-Plasma 2012; Izmir, Turkey.
Conference chair; Symposium on Graphene Nanotechnology (satellite conference of Nano Korea 2012), 2012; Seoul, Korea.
International Organization Committee member; 4th International Conference on Recent Progress in Graphene Research, 2012; Beijing, China.
International Organization Committee member; 5th International Conference on Recent Progress in Graphene Research, 2013; Tokyo, Japan.
Program Co-chair; 14th International Conference on the Formation of Semiconductor Interfaces 2013; Gyeongju, Korea.
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[Research interests]
Prof. Lee’s research interests include
- Phase-coherent electrical transport in mesoscopic and nanoscale structures
- Critical phenomena in reduced dimensions
- Intrinsic Josephson phenomena in nano-stacked cuprate crystals, etc.
More recently he contributed to research on spin-polarized and thermoelectric transport in graphene, superconductive proximity coupling and phase-coherent phenomena in graphene and topological insulators.

[Abstract]
In this lecture I will introduce the electronic negative refraction we realized in a high-mobility
monolayer graphene sheet with a p-n potential boundary. Given the Dirac band structure of the graphene, the transmission of electrons through a p-n junction is predicted to be similar to the optical refraction at the boundary of metamaterials with negative refractive index [1]. In consequence, electronic waves injected at a point in one side of a junction can be refocused into a single point in the other side of the junction, which demonstrates Veselago lensing for the electrons. By adopting high-yield dry-transfer technique, we fabricated fully ballistic graphene devices encapsulated by hexagonal boron nitrides with a local top gate. We will present the signatures of negative refractive transport behavior of electrons in p-n junctions and the electronic current focusing in p-n-p heterojunctions (see figures below) in terms of Veselago lensing [2]. Our study confirms great potential for engineering electronic wave propagation in a ballistic and coherent Dirac medium in general. This study also demonstrates that, with a long mean free path at room temperature, graphene promises highly novel components for electronic optics operating at high temperatures.