Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Double-walled carbon nanotubes as one-dimensional moiré crystals[1] PILKYUNG MOON, NYU Shanghai, MIKITO KOSHINO, Tohoku University, YOUNG-WOO SON, Korea Institute for Advanced Study — Being multi-shell structure, the well-defined atomic periodicity is hardly realizable in double-walled nanotubes because the periodic units of individual tubes therein cannot match well except very few cases, posing a challenge to understand its physical properties. Here we show that moiré patterns generated by superimposing atomic lattices of individual tubes are decisive in determining its electronic structures [1]. By using double-walled carbon nanotubes as an example, we demonstrate that even the combination of semiconducting nanotubes with almost the same physical properties such as diameter and energy gap can end up with very different double-walled nanotubes, of which electronic properties vary from metallic to semiconducting and further to insulating states, depending on the interlayer moiré interference. Our study puts forth a new classification of nanotubes as the first example of one-dimensional moiré crystals and paves a firm ground to utilize superb technological merits of double-walled carbon nanotubes. [1] Mikito Koshino, Pilkyung Moon, and Young-Woo Son, arXiv:1410.7544 (2014).

[1]P.M. was supported by NYU Shanghai Start-up Funds, M.K. was supported by JSPS Grant-in-Aid for Scientific Research 24740193 and 25107005. Y.-W.S. was supported by NRF funded by MSIP of Korean government (CASE 2011-0031640, QMMRC R11-2008-053-01002-0).

Pilkyung Moon
NYU Shanghai

Date submitted: 12 Nov 2014 Electronic form version 1.4