UV to terahertz signal conversion using graphene nanoribbons

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In this presentation, we propose a signal conversion from UV light into terahertz (TH_Z) radiation by performing the first-principles simulations. By employing the real-time propagation time-dependent density functional theory (rtp-TDDFT) with Ehrenfest molecular dynamics (MD), we monitored induced electric field (E-field) near a sheet of graphene nanoribbon under applying alternating E-field with frequencies of UV region. We have selected armchair nanoribbon as our target due to their thermal stability compared to zigzag nanoribbons.

We applied alternative E-field on armchair graphene nanoribbons, with several ribbon widths N=7, 9, 11, where N expresses a number of C-C dimers parallel to the ribbon axis along with the ribbon width. When frequency of applied E-field is above 6 eV, the induced E-field suddenly increases beyond the intensity of the applied one. Meanwhile the increased intensity is not sustainable, but shows modulation of E-field in a period around 100 fs corresponding to 10 TH_Z oscillation.

The increase and modulation can be interpreted as resonant response and interference of several electronic states and we expect current finding would be useful for TH_Z radiation by applying graphene nanoribbon.