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Nonlinear Photonics and Optoelecteonics of 2D Materials

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Our research interests are mainly focused on the light-matter interactions in 2D materials. In order to fabricate improved graphene photodetectors working in different spectral ranges, we integrated graphene with other 2D materials with variant electronic structures, *for example*, graphene/perovskite for visible light detection, graphene/$MoTe_2$ and graphene/$Cu_{3-x}P$ for near infrared light detection, and graphene-Bi_2Te_3 for broadband infrared light detection. It is found that the photo-gating effect plays an important role to amplify the photocurrent. Furthermore, we developed new methods to grow and transfer large area single crystal WS_2, large area MoS_2/WS_2 heterojunction array, and monolayer-bilayer WSe_2 heterojunction, and demonstrated their applications for highly responsive photoelectric devices with large photo-active area. We investigated plasmonic excitation and THz modulation in graphene/Bi_2Te_3, graphene nanoribbon and 3D graphene using either spectroscopic or real space imaging techniques. The important discoveries include the plasmonic coupling of two Dirac materials, excitation of high-order mode [9] and edge chirality-related plasmonic broadening. Lastly, we report our recent progress on the synthesis of 2D non-layered perovskite nanosheets as well as their optoelectronic applications in waveguide, photodetectors, fiber lasers, LED and solar cells. In summary, the advances of 2D materials may pave the way for the next generation photonic and optoelectronic applications.

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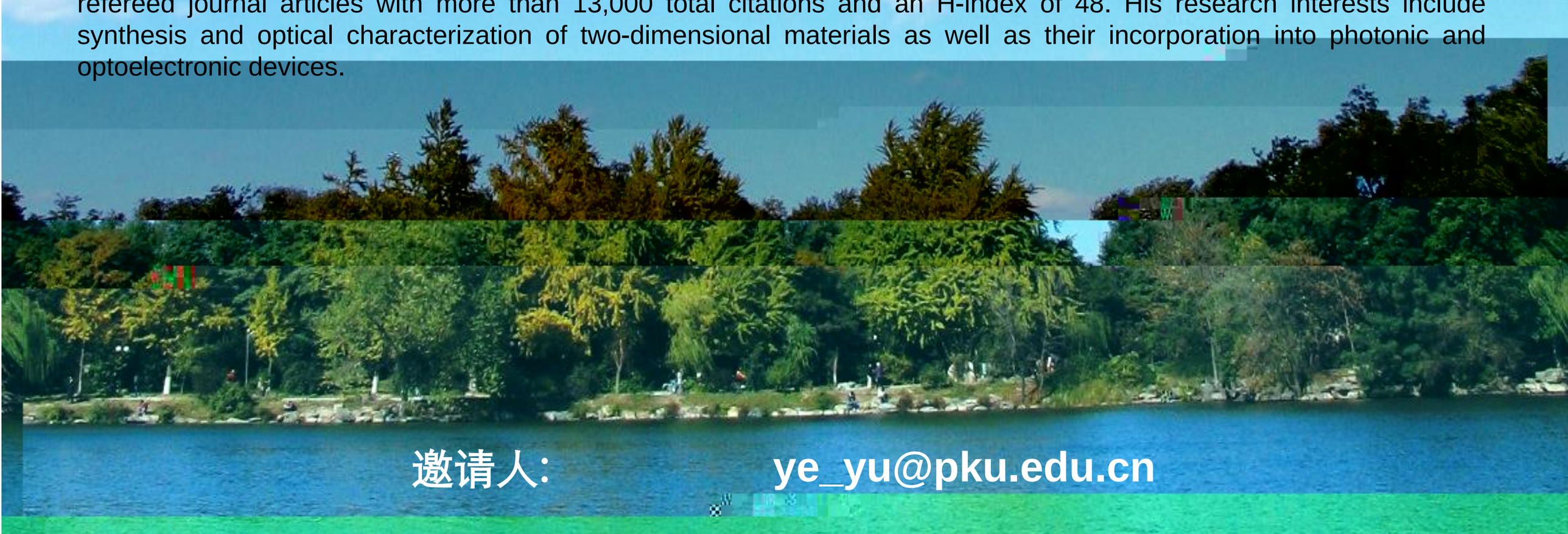

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Photoed by Xiaodong Hu