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First-principles many-body comparative study of  $\text{Bi}_2\text{Se}_3$  crystal: A promising candidate for Broadband Photodetector

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## Highlights

- First study of  $\text{Bi}_2\text{Se}_3$  by Bethe-Salpeter equation (BSE) of many-body perturbation theory (MBPT) method.
- The band gap of 0.36 eV has been obtained from PBE+GW approximation.
- The influences of electron-hole interactions on optical properties are confirmed.
- The exciton energy shows that the title material can absorb a photon within infrared wavelengths.

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