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We present recent advances in the development of a machine learning potential for carbon using the Gaussian approximation potential framework. Previous models have demonstrated the accuracy and transferability of GAP models for carbon by focusing on graphene[1] and the amorphous phases[2] respectively. Building on this, we construct a potential which is capable of accurately modelling the properties of both the crystalline allotropes and amorphous phases of carbon, including defects. We demonstrate this transferability by modelling the properties of the crystalline phases, including phonon dispersion curves, formation energies and defect formation energies and structures. Additionally we demonstrate accurate modelling of the liquid phase radial distribution function and the diamond-liquid and graphite-liquid phase coexistence lines of the phase diagram of carbon.

[1] P. Rowe, G. Csányi, D. Alfè, and A. Michaelides, Phys. Rev. B **97**, 054303 (2018).
[2] V.L. Deringer and G. Csányi, Phys. Rev. B **95**, 094203 (2017).