Supporting Information for

Two Dimensional Dirac Carbon Allotropes from Graphene

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Fig. S1 Phonon band structure of $S$-graphene

Fig. S2 Snapshots of (a, b)$S$-graphene, (c, d)$D$-graphene and (e, f)$E$-graphene after a 3ps FPMD simulation at 500K
**Fig. S3** Relative energies of new structures. The configuration of uududu allotrope is ↑↑↓↑↑↑↑.
Fig. S4 (a) Crystal structure and (b) electronic structure of $A$-graphene

Fig. S5 (a) Crystal structure and (b) electronic structure of $B$-graphene
Fig. S6 (a) Crystal structure and (b) electronic structure of $T_f$-graphene
Fig. S7 crystal structures and band structures of metallic (a, b) $S_F$-graphene, (c, d) $T_F$-graphene and (e, f) graphene allotrope with configuration of $\uparrow\uparrow\downarrow\downarrow\uparrow\uparrow$. 