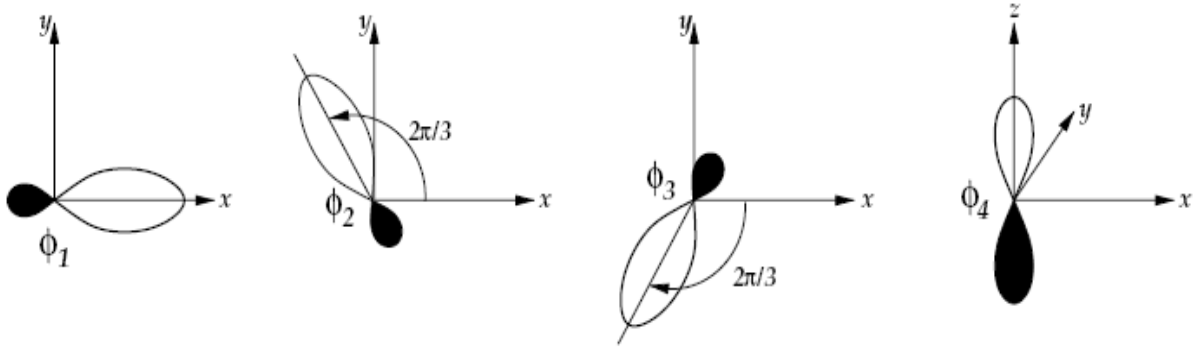
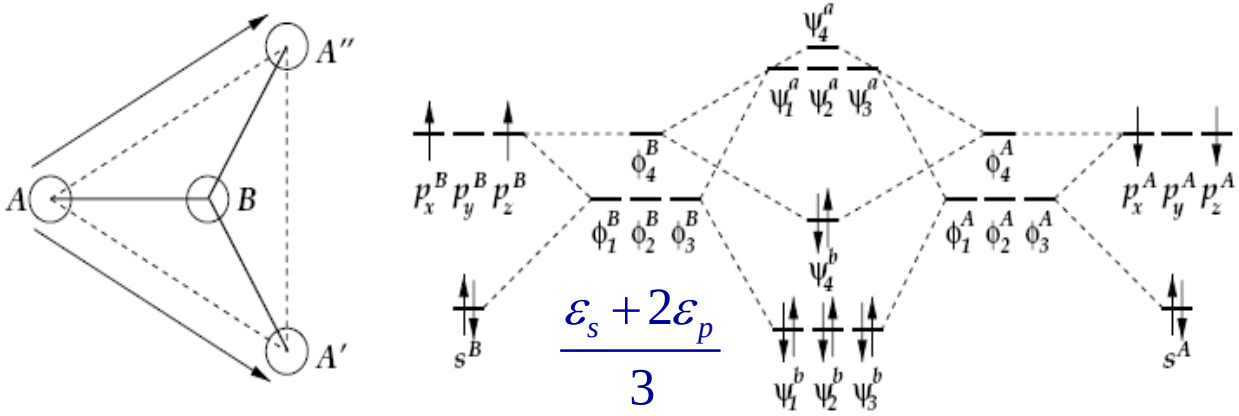
Chemistry of Graphene: sp^2 hybridization, Covalent Bonds, and All That



$$C: 1s^2 2s^2 2p^2$$



$$\phi_1^{A,B} = \frac{1}{\sqrt{3}} s^{A,B} \pm \sqrt{\frac{2}{3}} p_x^{A,B}$$

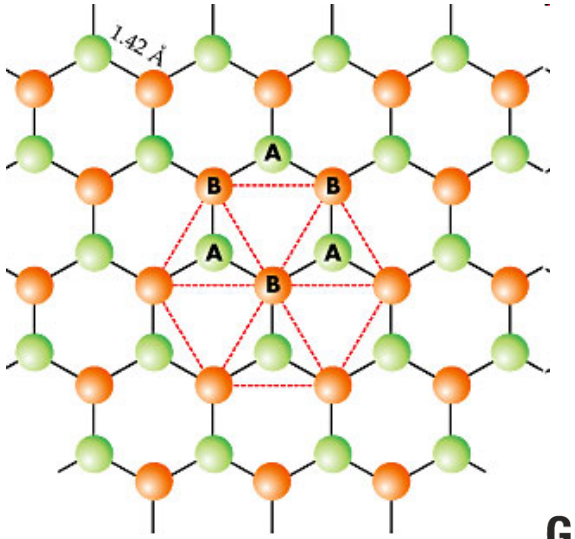
$$\phi_2^{A,B} = \frac{1}{\sqrt{3}} s^{A,B} \mp \frac{1}{\sqrt{6}} p_x^{A,B} \pm \frac{1}{\sqrt{2}} p_y^{A,B}$$

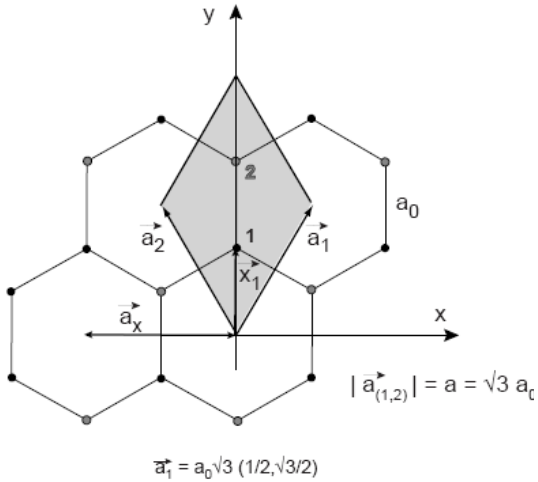
$$\phi_3^{A,B} = \frac{1}{\sqrt{3}} s^{A,B} \pm \frac{1}{\sqrt{6}} p_x^{A,B} \pm \frac{1}{\sqrt{2}} p_y^{A,B}$$

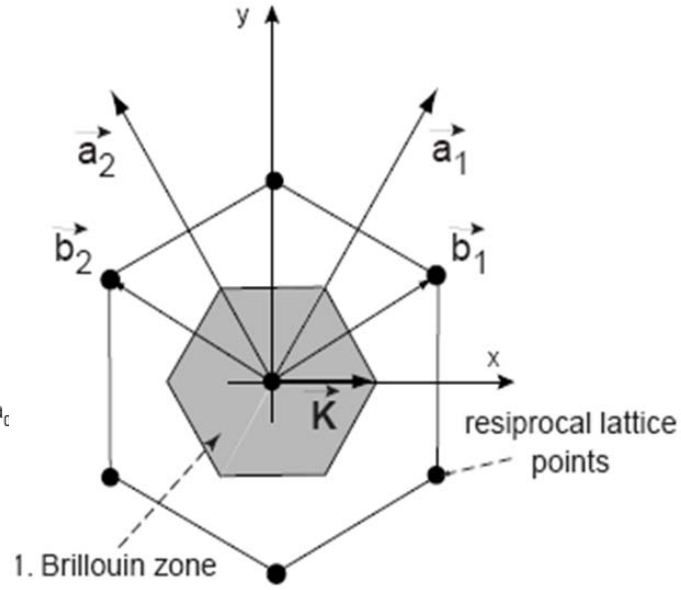
$$\phi_4^{A,B} = p_z^{A,B}$$

$$\Psi_i^{\text{b(onding)}} = \frac{1}{2}\left(\phi_i^A + \phi_i^B\right), \quad \Psi_i^{\text{a(ntibonding)}} = \frac{1}{2}\left(\phi_i^A - \phi_i^B\right)$$

Solid State Physics of Graphene: Lattices (real and reciprocal) and Electronic Band Structure







Graphene: Status and Prospects

A. K. Geim

Graphene is a wonder material with many superlatives to its name. It is the thinnest known material in the universe and the strongest ever measured. Its charge carriers exhibit giant intrinsic mobility, have zero effective mass, and can travel for micrometers without scattering at room temperature. Graphene can sustain current densities six orders of magnitude higher than that of copper, shows record thermal conductivity and stiffness, is impermeable to gases, and reconciles such conflicting qualities as brittleness and ductility. Electron transport in graphene is described by a Dirac-like equation, which allows the investigation of relativistic quantum phenomena in a benchtop experiment. This review analyzes recent trends in graphene research and applications, and attempts to identify future directions in which the field is likely to develop.