

Condensed Matter Physics I

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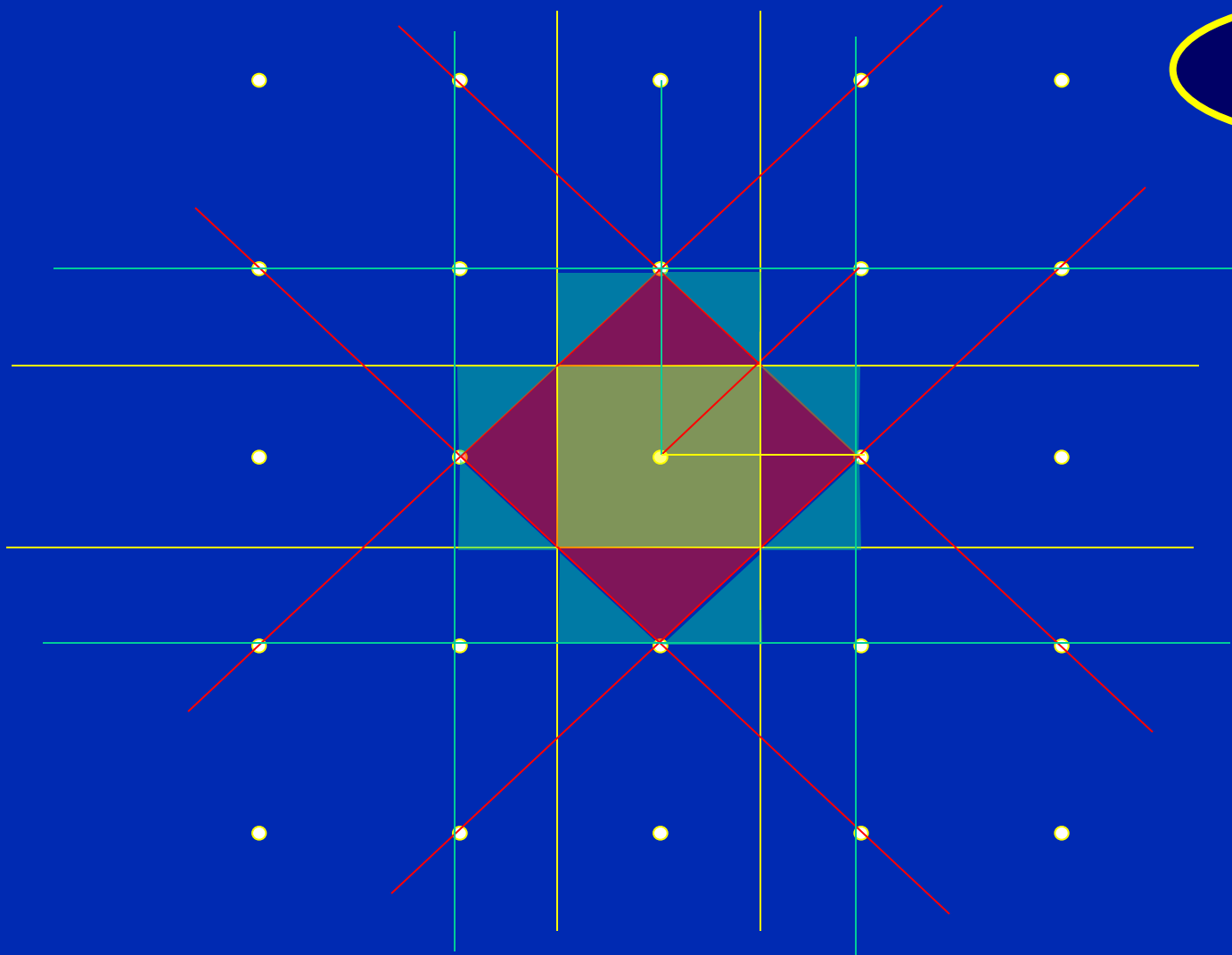
Previously

- Free electron model + perturbation
- Tight binding model + perturbation

Today

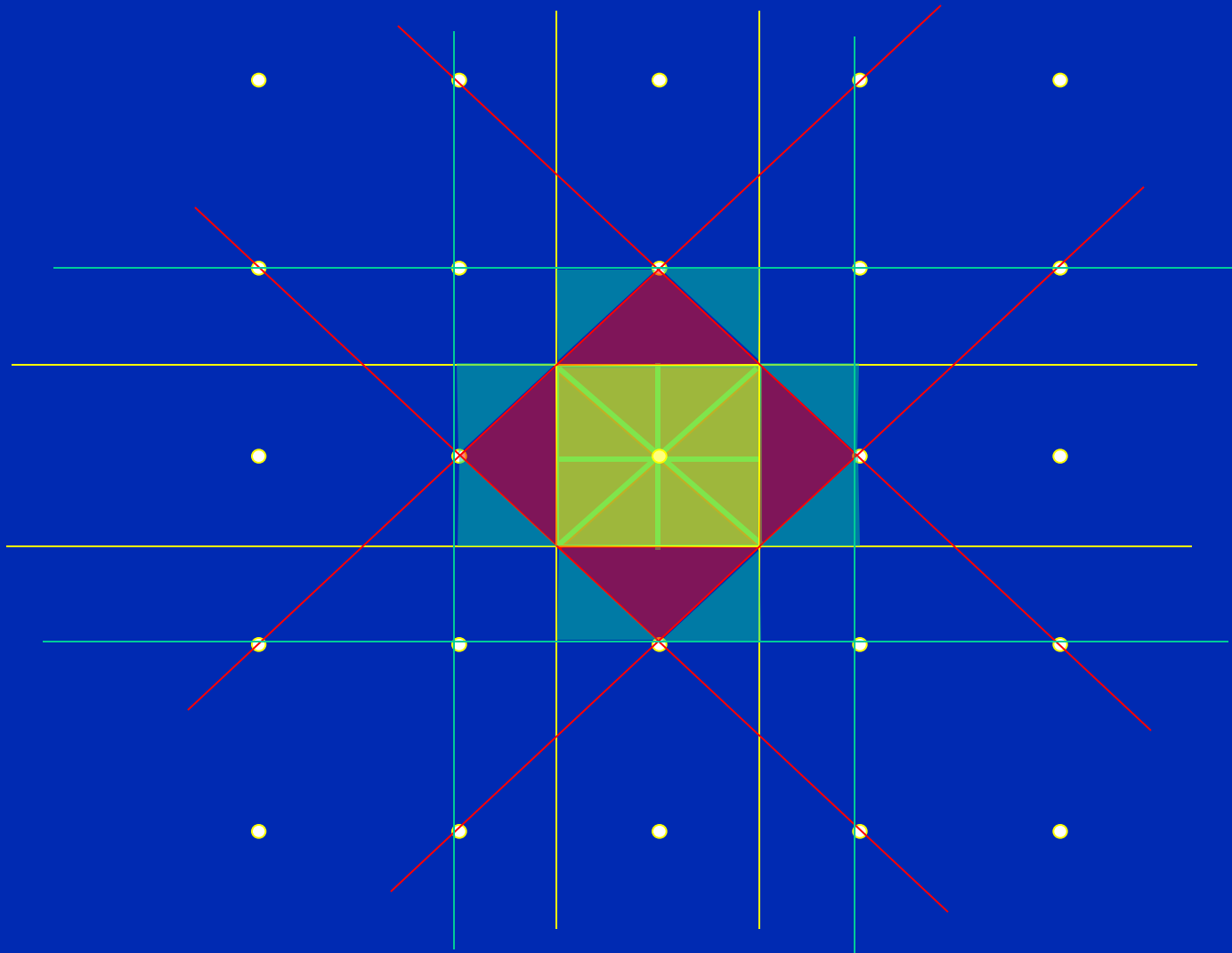
- Tight binding in second quantization
- Fermi surfaces

Brillouin zones in 2D

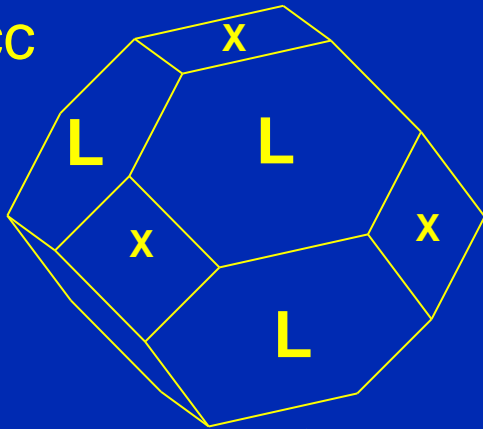


$$\Delta\vec{k} = n \cdot \vec{G}$$

Brillouin zones in 2D



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$N_e = 1$ (examples: Cu, Ag, Au)

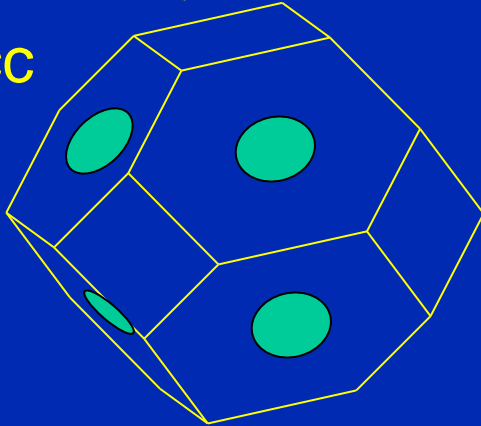
$$k_F a / 2\pi = (3/2\pi)^{1/3} = 0.78$$

$$|L| a / 2\pi = |(0.5, 0.5, 0.5)| = 0.87$$

$$|X| a / 2\pi = |(1, 0, 0)| = 1.0$$

$$V_{BZ} / (2\pi)^3 = 4/a^3$$

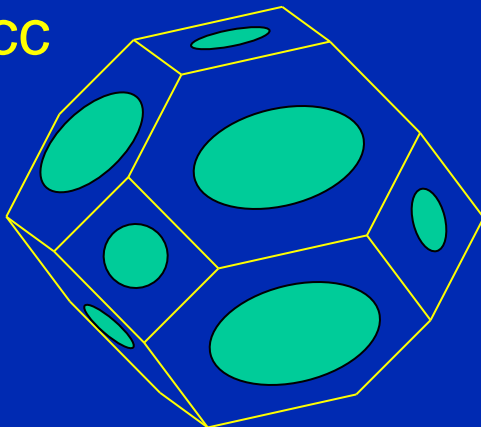
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$N_e = 2$ (examples: Ca, Sr)

$$k_F a / 2\pi = (3/\pi)^{1/3} = 0.98$$

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$N_e = 3$ (examples: Al, Ce, Th)

$$k_F a / 2\pi = (9/\pi)^{1/3} = 1.13$$

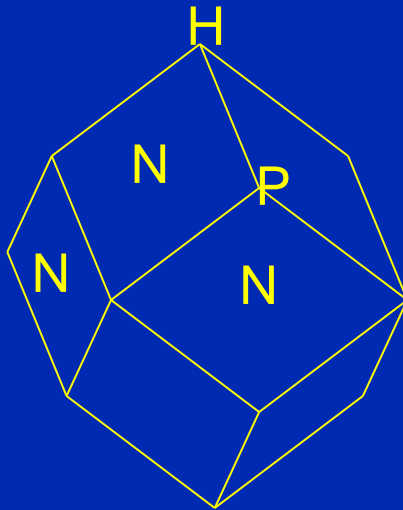
$$|N| a/2\pi = |(0.5,0.5,0)| = 0.71$$

$$|P| a/2\pi = |(0.5,0.5,0.5)| = 0.87$$

$$|H| a/2\pi = |(1,0,0)| = 1$$

$$V_{BZ}/(2\pi)^3 = 2/a^3$$

bcc

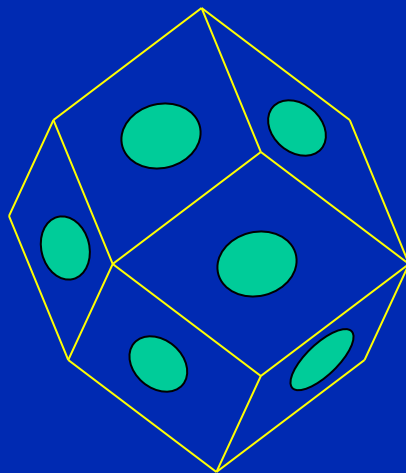


$$N_e = 1$$

examples: Li, Na, K, Rb, Cs

$$k_F a/2\pi = (3/4\pi)^{1/3} = 0.62$$

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$$N_e = 2$$

examples: Ba

$$k_F a/2\pi = (6/4\pi)^{1/3} = 0.78$$

- Fermi surfaces

- Tight binding method

