

Quantum Mechanics-2 HW#2

Due 9:00am, March 29, 2010 (Mon).

No late HW will be accepted. So turn in whatever you have done.

1. (25%) (Kronnig-Penney model) A particle is moving in a periodic potential

$$V(x) = \sum_{n=-\infty}^{\infty} v_0 \delta(x - na)$$

where v_0 is a positive constant. In the region $0 < x < a$, one has

$$\Psi = Ae^{iqx} + Be^{-iqx}$$

and $E = \hbar^2 q^2 / 2m$. Thus the Bloch wave function is

$$\phi_k = Ae^{i(q-k)x} + Be^{-i(k+q)x}$$

Show that

$$\cos ka = \cos qa + \frac{mav_0}{\hbar^2} \frac{\sin qa}{qa}$$

What is the meaning of k ?

2. (25%) Sakurai 4.7, p.283 (plane wave and spin-1/2 under parity)
3. (25%) Sakurai 4.9, p.283 (momentum-space WF under time reversal)
4. (25%) Sakurai 4.11, p.283 (quenching of orbital angular momentum)