Physics 3740 **Answers to HW N° 5** (Chapter 5)

(6) 0.202 nm (8) (a) 25.6 eV (b) 2.10 MeV (c) 510 MeV

(15) $n=1$: $\phi = 12°$, $n=2$: $\phi = 24.6°$, $n=3$: $\phi = 38.6°$,
$n=4$: $\phi = 56.4°$ (largest possible ϕ; for $n>4$ $\sin\phi$ would have to exceed 1)

(17) (a) $y(x,t) = 0.004 \cos(0.2x - 10t)\cos(7.8x - 390t)$ (b) $50 \frac{m}{s} = v_p$
(c) $v_g = 50 \frac{m}{s}$ (d) nondispersive, $\Delta x = 5\pi$ m, $\Delta x \Delta k = 2\pi$.

(20) $\Delta f \approx 0.6$ Hz (25) (a) $A^2 dx$ (b) $0.61 A^2 dx$ (c) $0.14 A^2 dx$
(d) at $x = 0$

(29) 1.99×10^{-21} eV (30) $\Delta p = \frac{p}{2\pi}$

(35) ≈ 9.33 fm (nuclei are of this order of size)

(37) Angular position cannot be specified at all in the Bohr model.

(45) (a) $E_1 \approx 204.9$ MeV, $E_2 \approx 819.6$ MeV, $E_3 \approx 1844$ MeV
(b) 2.02×10^{-6} nm $= 2.02$ fm (c) 1.21×10^{-6} nm $= 1.21$ fm (d) 7.56×10^{-7} nm $= 0.756$ fm

(49) (a) 0.243 nm (b) 0.511 MeV (c) $0.511 \frac{\text{MeV}}{c}$
(d) 2.43×10^{-3} nm

(51) $\frac{v}{c} = \sqrt{1 - \left(\frac{mc^2}{hf}\right)^2}$ [exact; if $mc^2 \ll hf$, use the binomial expansion]