EDIII Exam 2 problems 2016

**Volume 2.**

**Section 64**

**Section 68**

1. A charge *e* passes with constant velocity ***v*** and impact parameter ** a neutral particle located at the origin. What is the dipole moment, its first time derivative, and its second time derivative as functions of time? What is the total radiation?
2. A beam of charged particles is scattered by a scattering center located at the origin. The beam initially is in the X direction. A detector in the XY plane measures the electromagnetic radiation. The polar angular position  of the detector is varied from 0 to . Plot in the same graph the variation in the measured intensity vs.  for polarization in the XY plane and for polarization perpendicular to the XY plane. Indicate the minimum and maximum values in terms of the integrals A and B defined in section 68.

**Section 78**

1. Find and review the original paper by Thomson that gives the total cross section by light scattering by free electrons. What was the experiment he was trying to explain?
2. What fraction of incident light is scattered from the 2D electron gas in a high mobility electron transistor with n2D = 1012 cm-2? What about for an optically thin film of Au, with d = 50 nm and n3D = 5.9 x 1022 cm-3?

**Volume 8.**

**Section 117**

1. Consider elastic scattering. What range of values can the scattering wavevector **q** take?
2. What rank 4 tensors can we construct out of products of the unit tensor pq with all permutations of indices *i,l,k,m* (4! = 24), ignoring ones that are the same by symmetry of pq?
3. Derive (117.14).
4. Show that if PQ is a 2D tensor where **P** = **A**x**B** and **Q** = **C**x**D**, that only double products of ik and no triple products are involved. See v2 Sec 6 footnote.
5. Derive (117.15).
6. Derive (117.18).
7. Derive (117.19).
8. For incident natural light propagating in the z direction, what is <eie\*k>? Iik? Ii e’i e’k? I|| & I (117.24)?
9. Derive (117.25) for the normalized intsnsity of scalar scattering of linearly polarized light.
10. Derive (117.26) for the total scalar scattering of natural light and its polarization ratio. Draw some diagrams to illustrate various cases.
11. Derive (117.27) for symmetric scattering of polarized light.
12. Derive (117.28) for symmetric scattering of natural light.
13. Derive (117.29) for antisymmetric scattering of polarized light.
14. Derive (117.30) for antisymmetric scattering of natural light.

Section 124

1. What is the phase factor for the wave scattered from dV at **r** relative to the wave scattered from a volume element at the origin?

