PHYSICS 535, Spring 2016 – HOMEWORK #3 Due 2/12/2016

Readings –

1) C.B. Moore, et al. The Case for Blunt-tipped lightning rods", *J. Appl. Met.*, (2002).
2) H. Kasemir, A contribution to the Electrostatic Theory of the Lightning Discharge", *J. Geophys. Res..*, (1960).
3) C.B. Moore, et al. Lightning Rod Improvement Studies, *J. Appl. Met.*, (2000),

Article Summary –
Article summaries should include what YOU think were the most important points in the chapter. If one section contained most of what you found valuable, you can focus on that section.

Article Questions –
In addition to your summary, pose two questions raised by each of the readings suitable for homework or class discussion. You should know how to answer one of these questions. (Treat the two CB Moore articles as one article for the purpose of questions)

PROBLEM SET #3

3-1) Calculate potential on axis for a disk of charge. Differentiate to get E.

3-2) A balloon sonde measures Electric field vs. altitude and deduces charge vs. altitude. If you knew charge vs. altitude, you could get E-field. Assume infinite slabs of charge given below. Calculate and plot E(z) vs. z. It should reproduce (roughly) Figure 3.10.

$\rho = 0.0\ \text{nC/m}^3 \quad 0 < z < 3\ \text{km}$
$\rho = 0.7\ \text{nC/m}^3 \quad 3 < z < 3.7\ \text{km}$
$\rho = 0.0\ \text{nC/m}^3 \quad 3.7 < z < 5\ \text{km}$
$\rho = -5.4\ \text{nC/m}^3 \quad 5 < z < 5.15\ \text{km}$
$\rho = 0.0\ \text{nC/m}^3 \quad 5.15 < z < 6\ \text{km}$
$\rho = 1.6\ \text{nC/m}^3 \quad 6 < z < 6.55\ \text{km}$
$\rho = -1.0\ \text{nC/m}^3 \quad 6.55 < z < 6.90\ \text{km}$

3-3) Repeat 3.2, but assume that the charge layers are not infinite in extent but have a finite radius R. Plot E(z) vs. z for R=1 km, for R=3 km, and for R=infinity (same as 3.2). Overlay the three plots on eachother.

3-4) Calculate the upper and lower screening layer charge density for reasonable assumptions about conductivity in clouds and free air and reasonable assumptions about charge density in clouds.

3-5) Reproduce the plots I posted with lecture 8.