

Home Work #9

(due Tuesday April 1, 2008)

1. The dark current from a PMT tube with electron gain of 10^6 is measured to be 2 nA. What is the corresponding electron emission rate from the photocathode. (Note, that dark current can be also due to the surface current leakages of PMT; in this problem we are ignoring the latter source) ,
2. Calculate the long-wavelength limit of the sensitivity of a photocathode layer with work function of 1.5 eV.
3. Find the transient time for an electron between typical dynodes in a PMT tube if the inter-dynode spacing is 12 mm and the potential difference is 150 V per stage. For simplicity assume a uniform electric field.
4. The gain per dynode δ of a 10-stage PMT varies as $V^{0.6}$ where V is the inter-dynode voltage. If the tube is operated at an overall voltage of 1000V, how much voltage fluctuation can be tolerated if the gain is not to change by more than 1%.
5. Simple Cherenkov detector is described at:

<http://cosray2.wustl.edu/tiger/science/instrument/cherenkov/>

Calculate expected light yield photons per m.i.p. muon of the Cherenkov signal for the cosmic muon passing the horizontally positioned detector (as if you were designing it). Pick-up the type of PMT appropriate for such a detector. Calculate amplitude of the current signal obtained with this PMT. Take all necessary parameters from the PDG, books, from web search, or from reasonable assumption.