

Photomultiplier Tube (PMT)

<http://elchem.kaist.ac.kr/vt/chem-ed/optics/detector/pmt.htm>

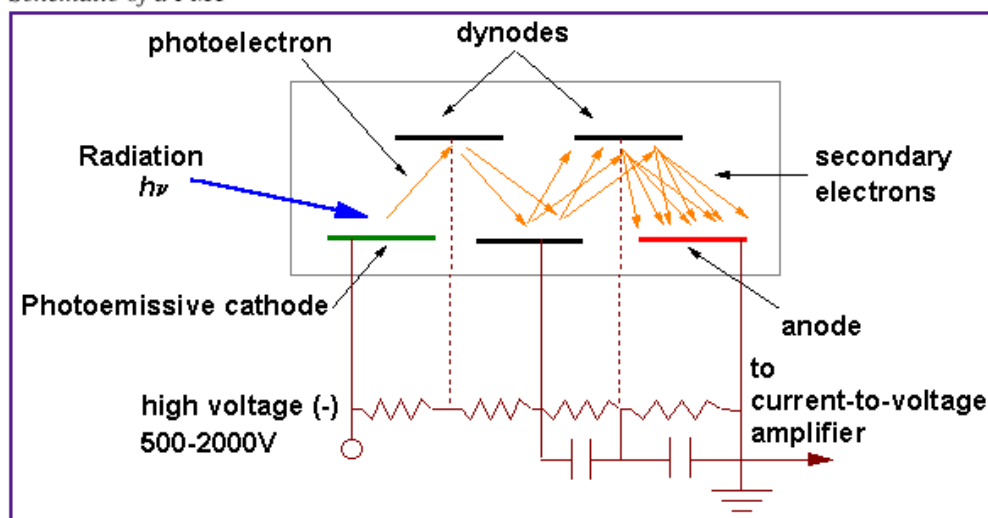
Introduction

Photomultiplier Tubes (PMTs) are light detectors that are useful in low intensity applications such as fluorescence spectroscopy. Due to high internal gain, PMTs are very sensitive detectors.

Design

PMTs are similar to phototubes. They consist of a photocathode and a series of dynodes in an evacuated glass enclosure. Photons that strike the photoemissive cathode emit electrons due to the photoelectric effect. Instead of collecting these few electrons (there should not be a lot, since the primary use for PMT is for very low signal) at an anode like in the phototubes, the electrons are accelerated towards a series of additional electrodes called dynodes. These electrodes are each maintained at a more positive potential. Additional electrons are generated at each dynode. This cascading effect creates 10^5 to 10^7 electrons for each photon hitting the first cathode depending on the number of dynodes and the accelerating voltage. This amplified signal is finally collected at the anode where it can be measured.

Schematic of a PMT



Typical specifications:

Wavelength range: 110-1100 nm

(wavelength sensitivity dependent on [wavelength](#), uv-sensitive PMTs must have uv-transmitting windows, see [optical materials](#))

Quantum efficiency (Q.E., number of electrons ejected by the photocathode / number of incident photons): 1-10%