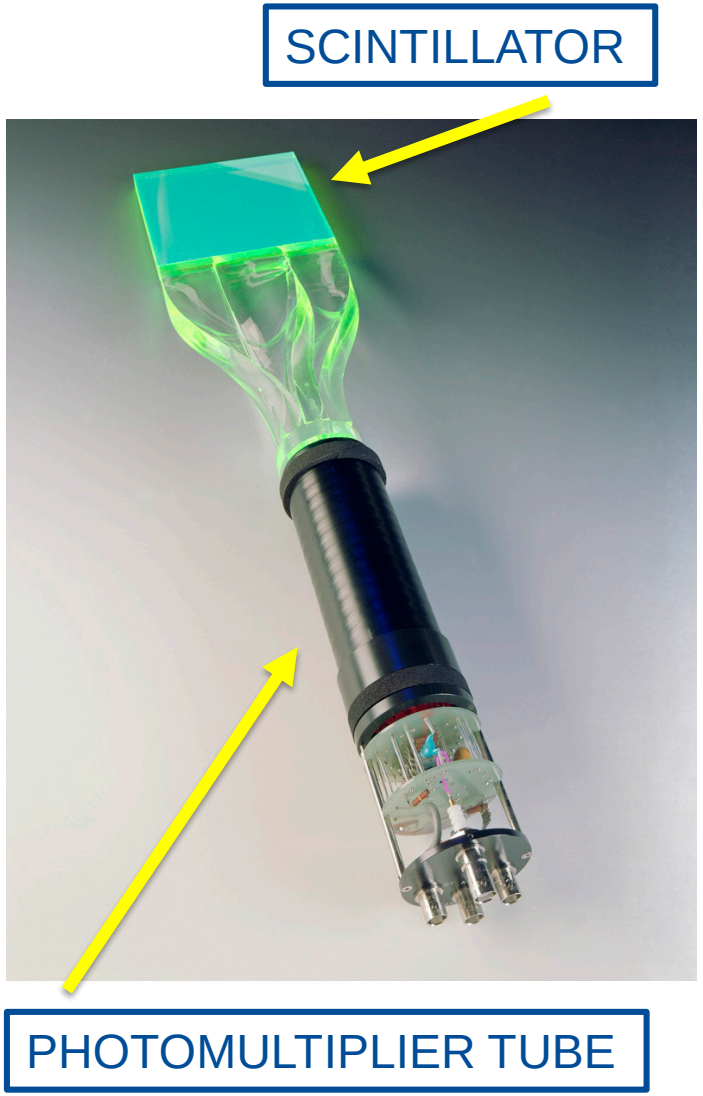
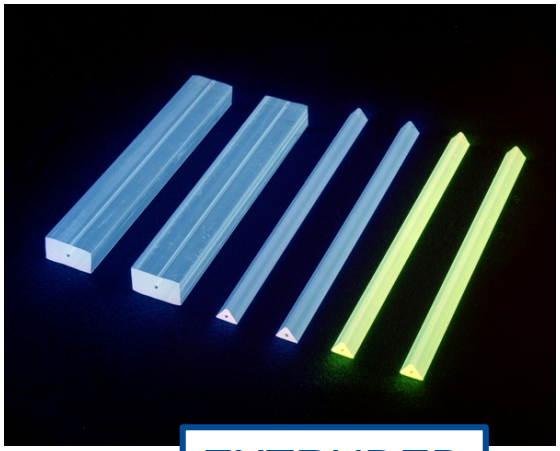
SCINTILLATION DETECTORS

- Certain materials emit light when a charged particle or ionizing radiation interacts with them.
- Photons emitted are converted into electrical pulses with a photomultiplier tube coupled to the scintillating material.
- Measurement and analysis of the electrical signal provides information about the incident radiation.



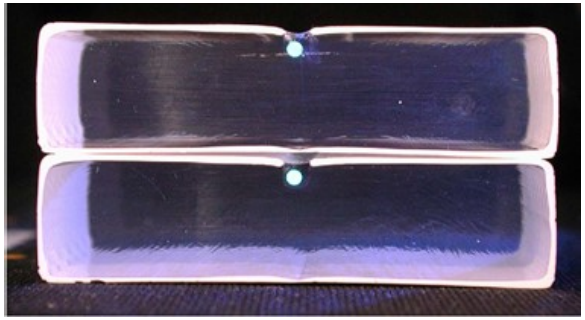
SCINTILLATION DETECTORS

- Liquids, gases, solids
  - Solids – crystals, glasses, plastics
    - My favorite → PLASTICS



EXTRUDED

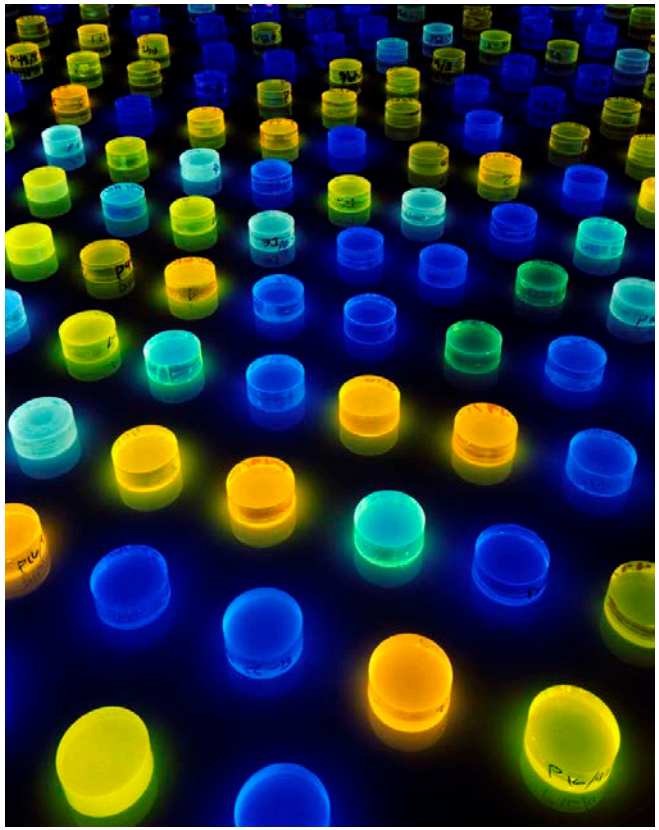
EXTRUDED



CAST

PLASTIC SCINTILLATION DETECTORS

- PLASTIC:
  - ✓ polystyrene (PS)
  - ✓ poly(vinyltoluene) (PVT)



- COLOR:

✓ First additive emits light in the deep blue.
  - Its light is not seen.

✓ Second additive shifts this light produced to longer wavelengths.

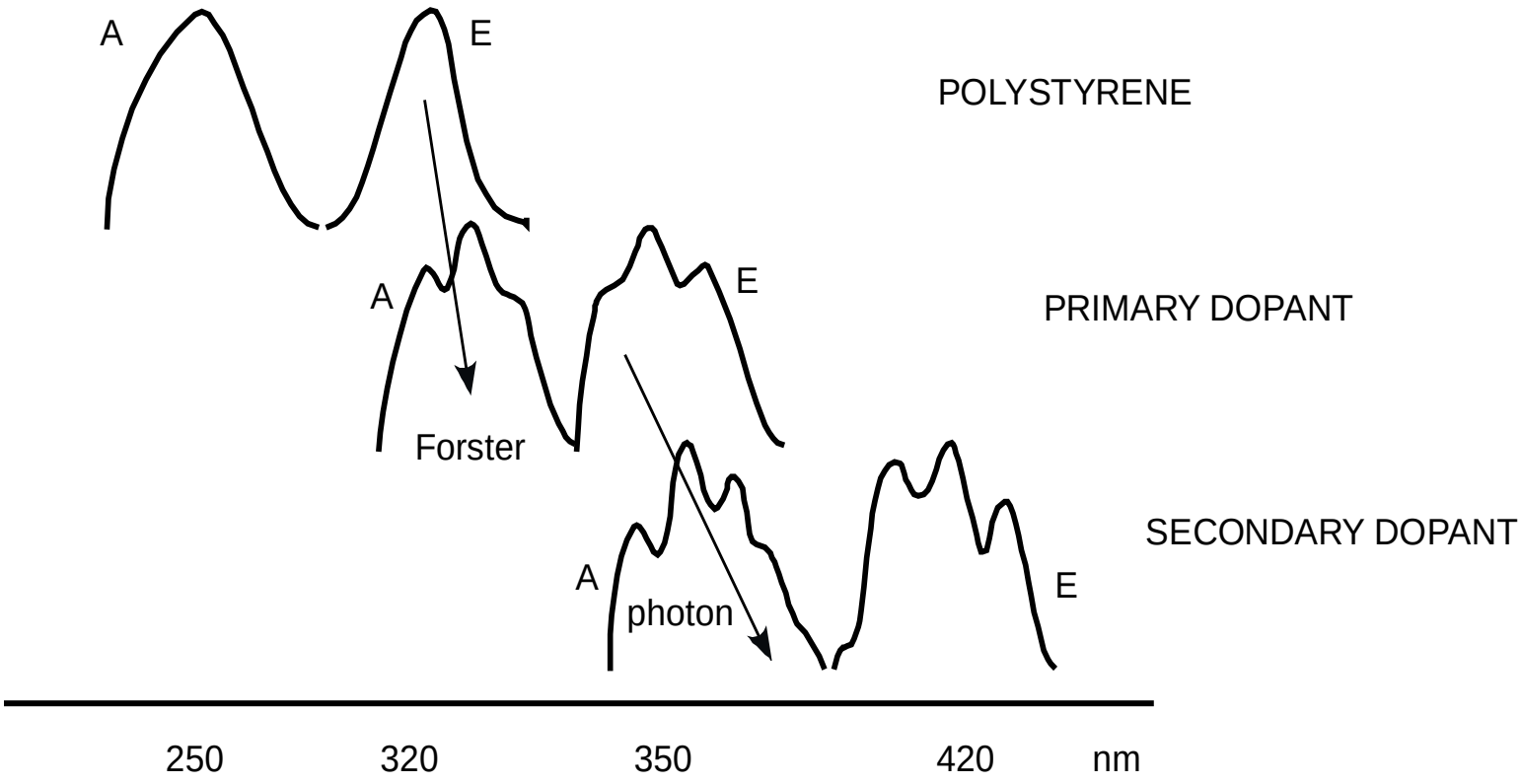
PLASTIC SCINTILLATOR MECHANISM

- Energy transfer from the ionizing radiation to the polymer matrix resulting in the excitation of the polymer molecules.

- Energy transfer from the polymer excited states to the primary dopant through Forster mechanism.

- Energy transfer between primary and secondary dopants through emission and reabsorption of a photon.

PLASTIC SCINTILLATOR MECHANISM



STANDARD COMPOSITION

BLUE SCINTILLATOR CORE

- Polystyrene: Dow Styron 665 W
- Dopants: 1% PPO + 0.03% POPOP

WHITE CAPSTOCKING – ONLY EXTRUDED SCINTILLATOR

- Polystyrene with 15% TiO_2 – 0.25 mm thick

READOUT WITH A GREEN FIBER

- Y11 fiber – 175 ppm K-27 – 1.2 mm diameter, multiclad