Exercise 9.1: Amorphous semiconductors

a) Determine the bandgap of amorphous Germanium from its Tauc plot at 300°K below.
b) What does the absorption in the low energy part of the spectrum correspond to?

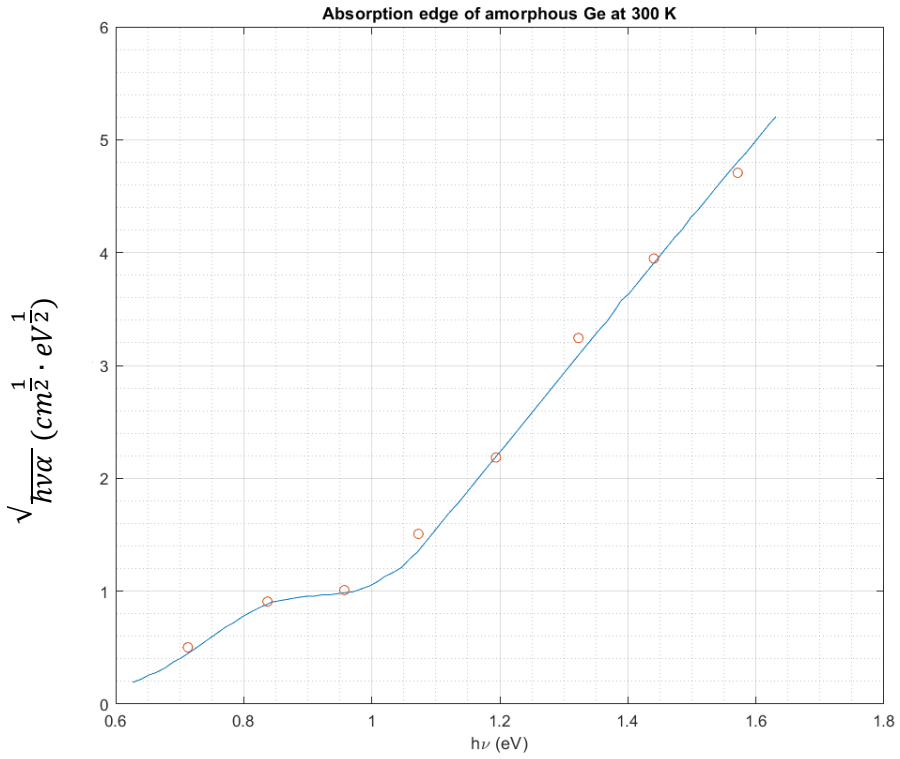

Figure 1: Tauc plot of amorphous germanium at 300°K

Exercise 9.2: Solar cells and photodiodes

a) What are the main differences between conventional (first and second-generation) solar cells and the third-generation solar cells presented in the lecture?

b) What is the common point between a solar cell and a photodetector? Estimate the responsivity at 800 nm of a photodetector made of a 10 µm thick anti-reflection coated silicon photodiode knowing that the absorption coefficient at this wavelength is equal to 1×10^5 m^{-1}.

c) Calculate the photocurrent generated when the photodiode is illuminated with a 1 mW beam from a semiconductor laser operating at this wavelength.

Exercise 9.3: Devices

Fig. 2 shows a band diagram of a highly-doped optoelectronic device without any external bias applied (a) and (b) with a bias applied. Can you say which device this band diagram refers to? Explain why.

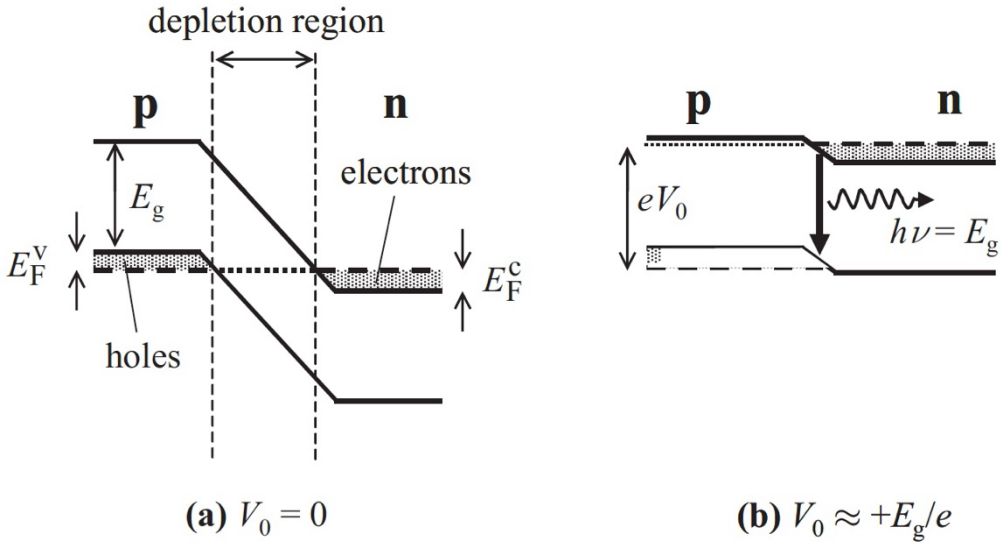

Figure 2: Band diagram of an optoelectronic device with a) No external bias applied, b) With external bias applied