Condensed Matter II

Problem set #5

Spring 2023

1 Density of states of Si, Ge, Sn

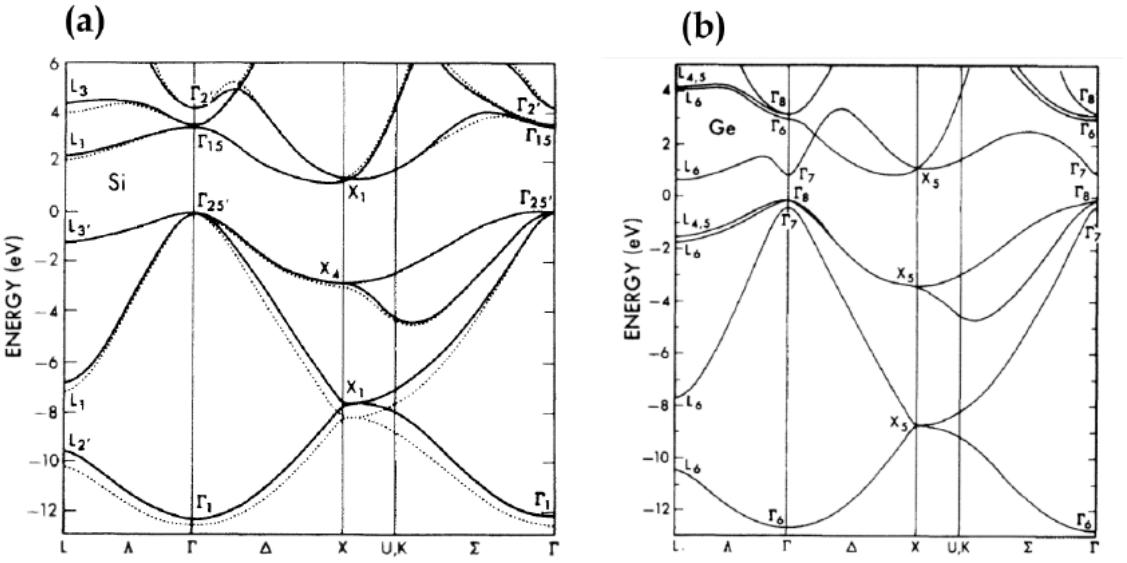

Figure 1: Band structure (a)Si and (b)Ge.

Based on the density of states of Si, Ge, and α-Sn displayed in Fig 2, comment on the density of states of the empty diamond lattice (assuming isotropic effective mass m_0 and lowest energy point of the density of states at $E_0 = -13\,\mathrm{eV}$). Where is the Fermi energy located?

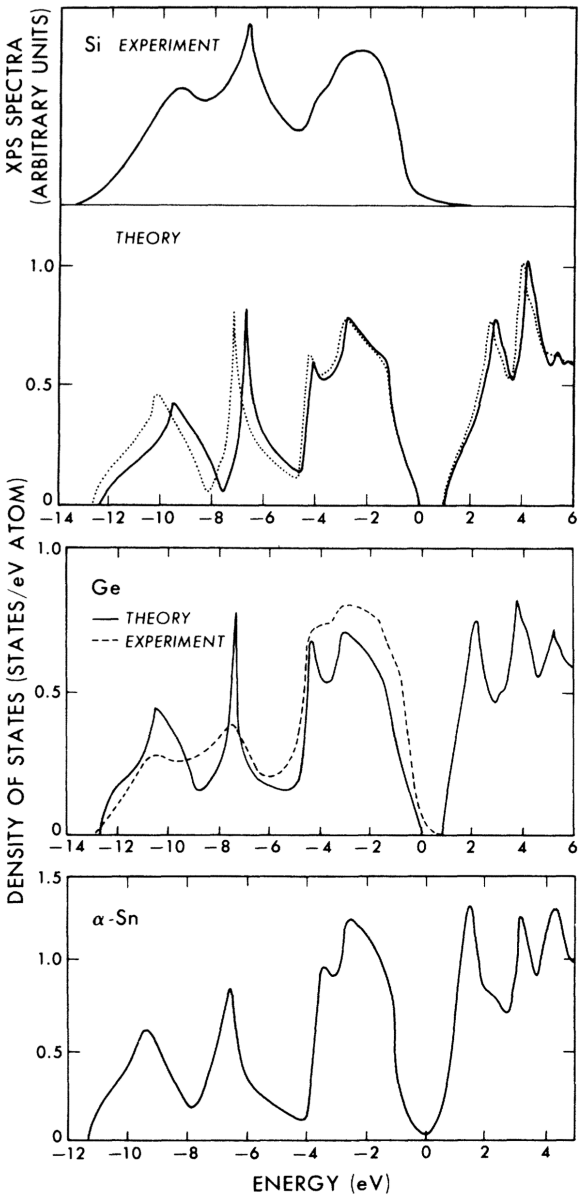

Figure 2: Calculated electronic densities of states compared to experiment for Si, Ge, and α-Sn. The experimental results for Si and Ge are from Pollak et al., PRL 29, 1103 (1973) and Grobman et al., PRL 29, 1508 (1972) respectively. In the case of Si, two results are displayed: nonlocal pseudopotential (solid line) and local pseudopotential (dashed line). R. Chelikowsky et al., PRB 14, 556 (1976)