

Physics 410/510

Experiment O-4

Optical Constants of Metals and Semiconductors

Objects:

1. To adjust and calibrate a Babinet Compensator.
2. To prepare the metal mirror by evaporation.
3. To measure the phase shift difference and the ratio of amplitudes of the two usual components of polarized light reflected by a mirror as a function of the angle of incidence. Do this visually at the red and green wavelengths of mercury, and photoelectrically at the green and blue wavelengths of mercury. Begin by making the same measurement visually in the green for a glass surface.
4. Calculate n and k for the metal and compute its conductivity. (We're neglecting bound charges so the conductivity calculation is not very good.) Repeat the same for the semiconductor (silicon).

References:

- * F.A. Jenkins and H.E. White, Fundamental of Optics, McGraw Hill 1976, Ch. 25, Reflection. (For more details, see Fundamentals of Physical Optics, McGraw 1937.)
- * M. Born and E. Wolf, Principles of Optics, Pergamon Press 1980, Ch. 13, Optics of Metals.
- * For some recent results of Al see E. Shiles et al., Phys. Rev. B 22, 1612 (1980); on Si see E. Schmidt, J. Appl. Optics 8, 1905 (1969), and Phys. Stat. Solidi 27, 57 (1986); for an example of modern ellipsometry, see K. Vedam, et al., Appl. Phys. Lett. 47, 339 (1985).

glass $n \approx 1.5$
gold $n \approx 0.47$
Si - $n \approx 4.01$

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