5. Magnification and Electron Sources

Problems

5.1. An electron probe with lateral diameter $d = 116$ nm diverges at a semi-angle $\alpha = 15.0$ mrad at a distance $p = 1.08$ cm in front of a lens with focal length $f = 0.82$ cm. In back of the lens, find:

a) The image distance *q*, b) the lateral magnification *M*,

c) the lateral size d' of the image, d) the angular magnification M_θ;

e) The convergence semi-angle α' of the image of the probe.

5.2. An electron source has brightness $\beta = 6.3 \times 10^9$ $\mathrm{A}/(\mathrm{cm}^2 \cdot \mathrm{sr})$.

a) An image of the source at point 1 has diameter $d_1 = 2.4$ μm and semi-angle of convergence $\alpha_1 = 8.2$ mrad. Find the probe current i_1.

b) A second image of the source at point 2 has diameter $d_2 = 28$ nm and current $i_2 = 12.3$ μA. Find the semi-angle of convergence α_2 (in mrad) at point 2.