Phase Contrast Halo Effect[1]
A. Havics

If one considers:

A phase object A (width w) on a semi-infinite background, e.g., a parallel sided glass slide with a rectangular band A (Figure 1). Positive phase contrast shows the area A dark against a bright background. Assuming w to be small, the light it diffracts spreads over the plane F (resultant image plane). The small portion of light diffracted and passing through the phase plate (Q) can be ignored. Thus there is a small dark band (negative relative intensity) representative of "A" rounded off at the edges (figure 2a). The rounding is from the small amount of diffracted light passing through Q.

However, as w increases, the overspreading of light diffracted along plane F recedes. The diffracted portion passing through the phase plate Q can not longer be ignored. It creates what Francon refers to as perturbations on either side of "A". These bright fringes (m and m') are the cause of the halo (Figure 2b). As w increases greatly, the diffraction along plane F reaches the size of the phase plate Q. Then only the two phase breaks on either side are dark and the two fringes creating a halo remain (Figure 2c).

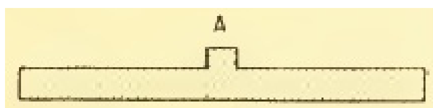

Figure 1. Phase Object A

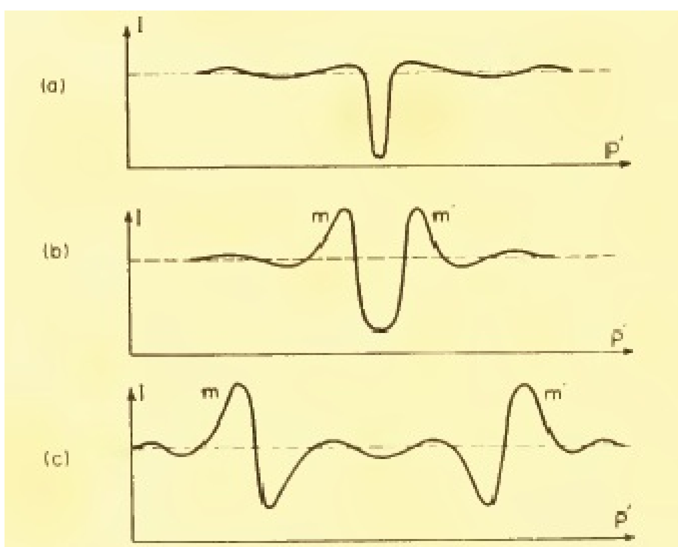

Figure 2. Resultant image plane.

---

[1] After Francon: "Chapter II, Phase Contrast Microscopy" in *Progress in Microscopy*, 67-90, 1961.