Abstract Submitted
for the NWS05 Meeting of
The American Physical Society

Minimum Beam Size of a Lens Exhibiting 3rd Order Spherical Aberrations THOMAS JONES, JENS ELSTNER, ROBERT WORD, GERTRUDE F. REMPFER, ROLF KOENENKAMP — In the field of electron microscopy, an important property is the minimum beam waist that electron beams can be focused to. The two main effects that determine this parameter are spherical aberration and diffraction. The goal of electron lens designers is to minimize these two effects. To accomplish this task the two effects are assumed to be independent of one an another and thus their deviations can be added in quadrature to determine the minimum beam size and the aperture angle for which this occurs. We have used an alternative method that makes no assumptions about the independence of the effects of spherical aberrations and diffraction. The method is based on a wavemechanical determination of the image intensity distribution. We calculate the optimum aperture angle and the minimum beam waist by numerically integrating the relevant Fresnel integrals incorporating third order aberration effects. Our values differ from those obtained in the conventional method that assumes the independence of spherical aberration and diffraction.

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Date submitted: 11 Apr 2005 Electronic form version 1.4