Claims

1. A multi-beam scanning electron microscopy apparatus comprising: a multi-beam scanning electron microscopy sub-system comprising: a multi-beam electron beam source including an electron gun configured to generate an illumination beam and a multi-lens array assembly configured to split the illumination beam into the plurality of electron beams, wherein the multi-lens array assembly is configured for adjusting focus of one or more lenses of the lens array assembly; a sample stage configured to secure a sample; an electron-optical assembly including a set of electron-optical elements configured to direct at least a portion of the plurality of electron beams onto a portion of the sample; and a detector assembly configured to simultaneously acquire a plurality of images of the surface of the sample, each image associated with an electron beam of the plurality of electron beams; a controller including one or more processors configured to execute a set of program instructions stored in memory for causing the one or more processors to: direct the multi-lens array assembly to establish a selected focus gradient across an image field of the sample to find a best focus configuration, wherein one or more features of the sample within the image field serve as one or more focus targets, wherein two or more lenses of the multi-lens array focus two or more electron beams of the plurality of electron beams to different foci on the one or more features of the sample; receive the plurality of images from the detector assembly, wherein at least some of the images have a different focus; identify the best focus configuration based on the received plurality of images; and direct the multi-lens array assembly to adjust a focus of one or more electron beams based on the focus of an electron beam corresponding with the identified best focus image.

2. The apparatus of claim 1, wherein the controller is configured to identify a best focus image of the plurality of images by analyzing one or more image quality parameters of at least some of the images of the plurality of the images.

3. The apparatus of claim 1, wherein the one or more image quality parameters comprise: image sharpness.

4. The apparatus of claim 1, wherein the multi-lens array assembly comprises: a set of lenses distributed across an array plate.

5. The apparatus of claim 1, wherein the multi-lens array is configured to adjust the voltage on one or more of the sets of lenses to establish a focus gradient across an image field of the sample.

6. The apparatus of claim 1, wherein the multi-lens array assembly is configured to adjust the separation between one or more plates of one or more lenses of the set of lenses to establish a focus gradient across an image field of the sample.

7. The apparatus of claim 1, wherein the multi-lens array assembly is configured to adjust the tilt of the array plate to establish a focus gradient across an image field of the sample.

8. The apparatus of claim 1, wherein the focus gradient is temporary.

9. The apparatus of claim 1, wherein the set of electron-optical elements comprise: at least one of a condenser lens or objective lens.

10. The apparatus of claim 1, wherein the detector assembly comprises: a detector array.

11. The apparatus of claim 1, wherein the detector assembly comprises: one or more secondary electron detectors.

12. The apparatus of claim 1, wherein the detector assembly comprises: one or more backscattered

electron detectors.

13. A multi-beam scanning electron microscopy apparatus comprising: a multi-beam scanning electron microscopy sub-system comprising: a multi-beam electron beam source including an electron gun configured to generate an illumination beam and a multi-lens array assembly configured to split the illumination beam into the plurality of electron beams, wherein the multi-lens array assembly is configured for adjusting astigmatism of one or more lenses of the lens array assembly; a sample stage configured to secure a sample; an electron-optical assembly including a set of electron-optical elements configured to direct at least a portion of the plurality of electron beams onto a portion of the sample; and a detector assembly configured to simultaneously acquire a plurality of images of the surface of the sample, each image associated with an electron beam of the plurality of electron beams; a controller including one or more processors configured to execute a set of program instructions stored in memory for causing the one or more processors to: direct the multi-lens array assembly to establish a selected astigmatism gradient across an image field of the sample to find a best astigmatism configuration, wherein two or more lenses of the multi-lens array focus two or more electron beams of the plurality of electron beams to so as to display different amounts of astigmatism; receive the plurality of images from the detector assembly, wherein at least some of the images have different amounts of astigmatism; identify the best astigmatism configuration based on the received plurality of images; and direct the multi-lens array assembly to adjust astigmatism of one or more electron beams based on a lens condition of an electron beam corresponding with the identified best astigmatism image.

14. A multi-beam scanning electron microscopy apparatus comprising: a multi-beam scanning electron microscopy sub-system comprising: a multi-beam electron beam source including an electron gun configured to generate an illumination beam and a multi-lens array assembly configured to split the illumination beam into the plurality of electron beams, wherein the multi-lens array assembly is configured for adjusting focus of one or more lenses of the lens array assembly; a sample stage configured to secure a sample; an electron-optical assembly including a set of electron-optical elements configured to direct at least a portion of the plurality of electron beams onto a portion of the sample; and a detector assembly configured to simultaneously acquire a plurality of images of the surface of the sample, each image associated with an electron beam of the plurality of electron beams; a controller including one or more processors configured to execute a set of program instructions stored in memory for causing the one or more processors to: direct the multi-lens array assembly to sweep at least one of the focus or astigmatism of one or more lenses during acquisition of one or more images corresponding with the one or more lenses to find at least one of a best focus configuration or a best astigmatism configuration, wherein the one or more images include an image of one or more features of the sample, wherein the one or more features serve as one or more focus targets; receive the one or more images from the detector assembly, wherein the one or more images; identify a point in the one or more images displaying at least one of best focus or best astigmatism by analyzing one or more image quality parameters across the one or more images; and direct the multi-lens array to adjust at least one of focus of one or more electron beams or astigmatism of the one or more electron beams based on at least one of the focus or astigmatism at the point in the one or more images displaying at least one of the identified best focus or the identified best astigmatism.