Coursera TEM Assignment week 2 – corrections

Prompt 1

Rubric 1:

The correct answer is: image 1 with objective aperture; image 2 without objective aperture

Rubric 2:

To arrive to this conclusion:
Image 1 has more pronounced dark areas (where the particles diffract strongly, and the objective aperture cuts the diffracted beams). Besides, the second image shows some ghost images around the strongly diffracting particles.

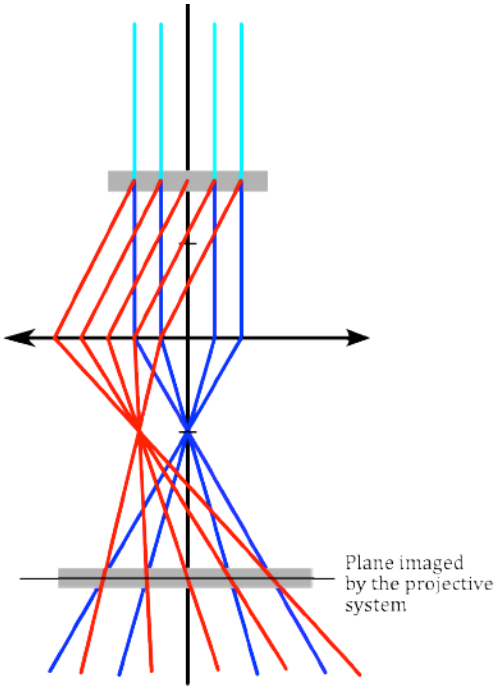
Prompt 2

Rubric 1:

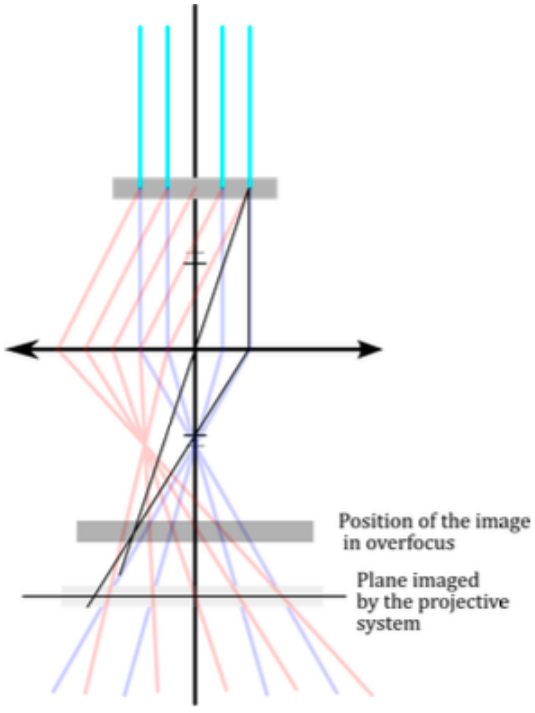
Image 1 corresponds to sketch D. It is a bright field image, with good contrast and no ghost images, hence used an objective aperture.
Image 2 corresponds to sketch A. It is a bright field image, but without aperture (lower contrast and has ghost images).
Image 3 corresponds to sketch C. It is a dark field image.

Prompt 3

We need to start from the usual drawing of the objective lens forming an image and diffraction pattern. We know that the projector system will image the plane where the first intermediate image forms.



The next step is to draw the image formation in overfocus. The objective lens has a stronger excitation. The focal points move closer to the lens. With this information, we can find the plane where the image is now forming.



The final step requires to draw the diffracted and undiffracted rays in this new configuration. On the plane imaged by the projector system, diffracted and undiffracted rays coming from the same place of the specimen do not converge at the same place. The diffracted beam forms an image slightly displaced (to the right on the drawing). This explains the ghost image, which is then obtained from the diffracted rays, and is hence a bright and displaced image of the specimen.