WHAT IS CLAIMED IS:

1. A system, comprising:

a vacuum chamber comprising a wafer chuck therein and side windows slanted relative to the wafer chuck, the wafer chuck configured to receive a wafer,

a wafer stage positioned below and mechanically coupled to the wafer chuck, the wafer stage configured to rotate the wafer chuck and move the wafer chuck in a vertical direction substantially perpendicular to the wafer chuck, wherein the wafer stage is outside the vacuum chamber;

a journal bearing that mechanically connects the wafer stage to the wafer chuck and extends through a bottom portion of the vacuum chamber with a vacuum seal;

illumination optics configured to receive light from a light source and direct the light through an illumination vacuum window of the side windows to an optical spot on the wafer, the illumination optics comprising an illumination corrector lens;

collection optics configured to receive the light from the optical spot through a collection vacuum window of the side windows and direct the light to a detector, the collection optics comprising a collection corrector lens; and

a transfer module configured to move the illumination optics and the collection optics parallel to the illumination vacuum window and the collection vacuum window respectively,

wherein the illumination corrector lens and the collection corrector lens are configured to reduce optical aberrations.

2. The system of claim 1, wherein the wafer stage is configured to rotate the wafer chuck and move the wafer chuck in the vertical direction without moving the wafer in a horizontal direction parallel to the wafer chuck.

3. The system of claim 1, wherein the illumination optics and the collection optics are mounted on the transfer module that is configured to move the illumination optics and the collection optics simultaneously.

4. The system of claim 3, wherein the light source and the detector are mounted on the transfer module that is configured to move the light source, the detector, the illumination optics and the collection optics simultaneously.

5. The system of claim 3, wherein the light source and the detector are separate from the transfer module and configured to be stationary when the transfer module moves the illumination optics and the collection optics.

6. The system of claim 1, wherein the illumination optics and the collection optics are outside the vacuum chamber.

7. The system of claim 6, wherein the illumination corrector lens and the collection corrector lens are spaced apart from the vacuum chamber.

8. The system of claim 7, wherein the illumination optics further comprise a polarizer and an optical objective selected from the group consisting of a single aspheric mirror and a pair of off-axis spherical mirrors.

9. The system of claim 1, wherein the transfer module is configured to move the optical spot at least between an edge of the wafer and a center of the wafer.

10. The system of claim 9, further comprising a controller configured to adjust a relative position of the optical spot on the wafer by rotating the wafer via the wafer stage, moving the optical spot via the transfer module, or a combination thereof.

11. The system of claim 9, wherein:

the transfer module comprises a stage on which the illumination optics and the collection optics are mounted, and

the stage is configured to move parallel to a longitudinal direction of the side windows.

12. The system of claim 1, wherein the side windows are substantially perpendicular to an optical path of the light and substantially transparent to the light.

13. The system of claim 1, wherein the detector is a spectrometer.

14. The system of claim 1, wherein the detector, the illumination optics and the collection optics are configured as an ellipsometer.

15. The system of claim 14, wherein the ellipsometer is configured as a spectroscopic ellipsometer having rotating polarizers.

16. The system of claim 1, further comprising a processing chamber connected to the vacuum chamber and configured to perform a surface treatment on the wafer in vacuum.

17. The system of claim 1, wherein the transfer module comprises slanted portions positioned on the side windows.

18. The system of claim 17, wherein the illumination corrector lens and the collection corrector lens are positioned on the slanted portions of the transfer module.

19. The system of claim 1, wherein:

the wafer stage comprises a rotational stage outside the vacuum chamber, and

the journal bearing connects the rotational stage outside the vacuum chamber to the wafer chuck inside the vacuum chamber.

20. A method of wafer characterization, the method comprising:

directing light through illumination optics and an illumination vacuum window of a vacuum chamber to an optical spot on a wafer placed on a wafer chuck in the vacuum chamber, the illumination optics comprising an illumination corrector lens, the illumination vacuum window being slanted relative to the wafer chuck;

detecting the light from the optical spot through collection optics and a collection vacuum window of the vacuum chamber, the collection optics comprising a collection corrector lens, the collection vacuum window being slanted relative to the wafer chuck; and

adjusting a relative position of the optical spot on the wafer by rotating the wafer via a wafer stage, moving the optical spot via a transfer module, or a combination thereof, wherein

the illumination corrector lens and the collection corrector lens are configured to reduce chromatic aberration,

the wafer stage is positioned below and mechanically coupled to the wafer chuck and configured to rotate the wafer chuck, and

the transfer module is configured to move the illumination optics and the collection optics parallel to the illumination vacuum window and the collection vacuum window respectively,

wherein the wafer stage, the illumination optics and the collection optics are outside the vacuum chamber,

wherein the wafer stage and the wafer chuck are mechanically connected via a journal bearing that extends through a bottom portion of the vacuum chamber with a vacuum seal.