CLAIMS

1. Apparatus for measuring a physical characteristic of an ophthalmic device, the apparatus comprising:

an optic mandrel for forming an ophthalmic device using free-form technology; said optic mandrel comprising an optical effect;

a lens cancellation system comprising one or more lenses to collectively cancel said optical mandrel's optical effect;

an emitter functional to emit a wavelength of radiation in a direction towards the ophthalmic device;

a sensor functional to detect a transmitted wavefront based upon the emitted wavelength, wherein the transmitted wavefront's intensity and phase will be different based upon a physical characteristic of said ophthalmic device, and

a processor in logical communication with one or both of the emitter and the sensor; wherein the processor is programmed to transmit a logical signal based upon the reflecting wavefront's intensity and phase.

2. The apparatus of claim 1 wherein the optic mandrel, the lens cancellation system, the emitter and the sensor are aligned.

3. The apparatus of claim 1 or claim 2 wherein the optic mandrel, the lens cancellation system, the emitter and the sensor are mounted on a rail.

4. The apparatus of claim 3, wherein the rail is a vertical optical rail.

5. The apparatus of any of the preceding claims wherein the sensor comprises a digital wavefront camera.

6. The apparatus of claim 5 wherein the digital wavefront camera is capable of moving to change or vary continuously a distance along an optical axis of transmission of two or more intensity profiles.

7. The apparatus of claim 5 or claim 6 wherein the digital wavefront camera is vibration insensitive.

8. The apparatus of any of claims 5 to 7 wherein the digital wavefront camera further comprises a beam splitter to cause a production of a second image at a different position along the optical axis of transmission.

9. The apparatus of any of claims 5 to 8 wherein the digital wavefront camera further comprises one or more magnification lenses dependant on the diaphragm in a light source and the working distance between the light source and the digital wavefront camera.

10. The apparatus of any of the preceding claims further comprising a kinematic mount for placement of said optical mandrel for proper alignment with the lens cancellation system and the emitter.

11. The apparatus of Claim 10 further comprising a vacuum for holding the mandrel fixture and the kinematic mount.

12. The apparatus of any of the preceding claims further comprising a top aperture and a bottom aperture, wherein said top aperture is slightly smaller than the bottom aperture and placed on top of the mandrel fixture without contacting said mandrel to create a physical barrier by limiting the light beam passing through defining a boundary condition for a solution of an intensity transport equation.

13. The apparatus of Claim 12 wherein said top aperture can be changed to cover a different field of view.

14. The apparatus of Claim 12 or claim 13 wherein said bottom aperture can also be changed to further improve a dynamic range of measurement.

15. The apparatus of any of the preceding claims wherein said lens cancellation system comprises an assembly comprising three lenses inside of a tube, wherein a light beam can pass through each of said lenses and may be placed perpendicularly to the rail.

16. The apparatus of Claim 15 wherein said three lens cancellation system can include one or more of: an asphere lens, a plano-convex lens and a plano-concave lens to cancel out one or both of: defocus, and spherical aberrations of the forming optic mandrel which subsequently allows light coming out of the mandrel to be collimated.

17. The apparatus of any of the preceding claims wherein the processor functions in real time to generate one or more continuous wavefront measurements of said ophthalmic device.

18. The apparatus of any of the preceding claims wherein the emitted radiation is a high quality light beam with a monochromatic wavelength.

19. The apparatus of any of the preceding claims wherein the emitted radiation comprises a monochromatic wavelength of from about 630nm to about 635mm.

20. A method for obtaining wavefront measurements of an ophthalmic device, the method comprising;

aligning an ophthalmic lens wavefront system,

taking an optical measurement of a forming optic mandrel and storing that intensity measurement of a forming optic mandrel as an intensity reference file,

taking an optical measurement of a forming glass mandrel with a lens that may have been formed on it and storing that intensity file,

using software in a processor capable of subtracting one intensity file from at least one other intensity file to obtain a value for an optical wavefront of a lens in real time.

21. The method of claim 20 further comprising the processor implementing an intensity transport equation and an algorithm.

22. The method of claim 20 or claim 21 wherein intensity data may subsequently be converted into an optical wavefront.

23. The method of claim 22 wherein the optical wavefront describes a path of light in terms of a light's intensity and phase.

24. The method of any of claims 20 to 23, wherein the ophthalmic lens wavefront system comprises the apparatus of any of claims 1 to 19.

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a lens cancellation system comprising one or more lenses to collectively cancel said optical mandrel's optical effect;

an emitter functional to emit a wavelength of radiation in a direction towards the ophthalmic device;

a sensor functional to detect a transmitted wavefront based upon the emitted wavelength, wherein the transmitted wavefront's intensity and phase will be different based upon a physical characteristic of said ophthalmic device, and

a processor in logical communication with one or both of the emitter and the sensor; wherein the processor is programmed to transmit a logical signal based upon the reflecting wavefront's intensity and phase.

2. The apparatus of claim 1 wherein the optic mandrel, the lens cancellation system, the emitter and the sensor are aligned.

3. The apparatus of claim 1 or claim 2 wherein the optic mandrel, the lens cancellation system, the emitter and the sensor are mounted on a rail.

4. The apparatus of claim 3, wherein the rail is a vertical optical rail.

5. The apparatus of any of the preceding claims wherein the sensor comprises a digital wavefront camera.

6. The apparatus of claim 5 wherein the digital wavefront camera is capable of moving to change or vary continuously a distance along an optical axis of transmission of two or more intensity profiles.

7. The apparatus of claim 5 or claim 6 wherein the digital wavefront camera is vibration insensitive.

8. The apparatus of any of claims 5 to 7 wherein the digital wavefront camera further comprises a beam splitter to cause a production of a second image at a different position along the optical axis of transmission.

9. The apparatus of any of claims 5 to 8 wherein the digital wavefront camera further comprises one or more magnification lenses dependant on the diaphragm in a light source and the working distance between the light source and the digital wavefront camera.

10. The apparatus of any of the preceding claims further comprising a kinematic mount for placement of said optical mandrel for proper alignment with the lens cancellation system and the emitter.

11. The apparatus of Claim 10 further comprising a vacuum for holding the mandrel fixture and the kinematic mount.

12. The apparatus of any of the preceding claims further comprising a top aperture and a bottom aperture, wherein said top aperture is slightly smaller than the bottom aperture and placed on top of the mandrel fixture without contacting said mandrel to create a physical barrier by limiting the light beam passing through defining a boundary condition for a solution of an intensity transport equation.

13. The apparatus of Claim 12 wherein said top aperture can be changed to cover a different field of view.

14. The apparatus of Claim 12 or claim 13 wherein said bottom aperture can also be changed to further improve a dynamic range of measurement.

15. The apparatus of any of the preceding claims wherein said lens cancellation system comprises an assembly comprising three lenses inside of a tube, wherein a light beam can pass through each of said lenses and may be placed perpendicularly to the rail.

16. The apparatus of Claim 15 wherein said three lens cancellation system can include one or more of: an asphere lens, a plano-convex lens and a plano-concave lens to cancel out one or both of: defocus, and spherical aberrations of the forming optic mandrel which subsequently allows light coming out of the mandrel to be collimated.

17. The apparatus of any of the preceding claims wherein the processor functions in real time to generate one or more continuous wavefront measurements of said ophthalmic device.

18. The apparatus of any of the preceding claims wherein the emitted radiation is a high quality light beam with a monochromatic wavelength.

19. The apparatus of any of the preceding claims wherein the emitted radiation comprises a monochromatic wavelength of from about 630nm to about 635mm.

20. A method for obtaining wavefront measurements of an ophthalmic device, the method comprising;

aligning an ophthalmic lens wavefront system,

taking an optical measurement of a forming optic mandrel and storing that intensity measurement of a forming optic mandrel as an intensity reference file,

taking an optical measurement of a forming glass mandrel with a lens that may have been formed on it and storing that intensity file,

using software in a processor capable of subtracting one intensity file from at least one other intensity file to obtain a value for an optical wavefront of a lens in real time.

21. The method of claim 20 further comprising the processor implementing an intensity transport equation and an algorithm.

22. The method of claim 20 or claim 21 wherein intensity data may subsequently be converted into an optical wavefront.

23. The method of claim 22 wherein the optical wavefront describes a path of light in terms of a light's intensity and phase.

24. The method of any of claims 20 to 23, wherein the ophthalmic lens wavefront system comprises the apparatus of any of claims 1 to 19.