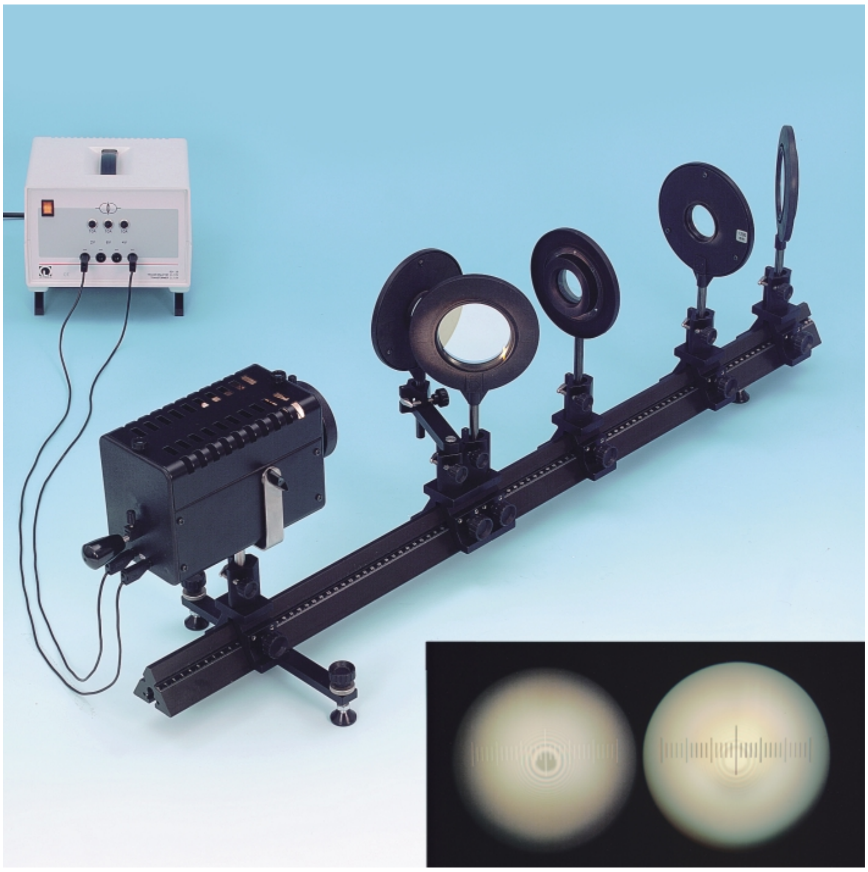

Newton's rings in transmitted and reflected white light (P 5.3.3.2)

P 5.3.3

Newton's rings

P 5.3.3.1 Newton's rings in transmitted monochromatic light

P 5.3.3.2 Newton's rings in transmitted and reflected white light

Cat. No.	Description	P 5.3.3.1	P 5.3.3.2
471 111	Glass plates for Newton's rings	1	1
460 03	Lens f = + 100 mm	2	
460 04	Lens f = + 200 mm		2
460 26	Iris diaphragm	1	
471 88	Beam divider		2
460 22	Holder with spring clips	1	
460 32	Precision optical bench, standardized cross-section, 1 m	1	1
460 370	Optics rider, H = 60 mm/W = 34 mm	6	5
460 373	Optics rider, H = 60 mm/W = 50 mm		1
460 380	Cantilever arm		1
451 111	Spectral lamp Na	1	
451 062	Spectral lamp Hg 100	1	
451 16	Housing for spectral lamps	1	
451 30	Universal choke 230 V, 50 Hz	1	
450 64	Halogen lamp housing 12 V, 50/100 W		1
450 63	Halogen lamp, 12 V/100 W		1
521 25	Transformer 2 ... 12 V		1
468 30	Mercury light filter, yellow	1	
468 31	Mercury light filter, green	1	
468 32	Mercury light filter, blue	1	
441 53	Translucent screen	1	
300 11	Saddle base	1	
501 33	Connecting lead, dia. 2.5 mm^2, 100 cm, black		2

Newton's rings are produced using an arrangement in which a convex lens with an extremely slight curvature is touching a glass plate, so that an air wedge with a spherically curved boundary surface is formed. When this configuration is illuminated with a vertically incident, parallel light beam, concentric interference rings (the Newton's rings) are formed around the point of contact between the two glass surfaces both in reflection and in transmitted light. For the path difference of the interfering partial beams, the thickness *d* of the air wedge is the defining factor; this distance is not in a linear relation to the distance *r* from the point of contact:

$$d = \frac{r^2}{2R}$$

R: bending radius of convex lens

In the first experiment, the Newton's rings are investigated with monochromatic, transmitted light. At a known wavelength λ, the bending radius *R* is determined from the radii r_n of the interference rings. Here, the relationship for constructive interference is:

$$d = n \cdot \frac{\lambda}{2} \quad \text{where } n = 0, 1, 2, \ldots$$

Thus, for the radii of the bright interference rings, we can say:

$$r_n^2 = n \cdot R \cdot \lambda \quad \text{where } n = 0, 1, 2, \ldots$$

In the second experiment, the Newton's rings are studied both in reflection and in transmitted light. As the partial beams in the air wedge are shifted in phase by $\lambda/2$ for each reflection at the glass surfaces, the interference conditions for reflection and transmitted light are complementary. The radii r_n of the bright interference lines calculated for transmitted light using the equations above correspond precisely to the radii of the dark rings in reflection. In particular, the center of the Newton's rings is bright in transmitted light and dark in reflection. As white light is used, the interference rings are bordered by colored fringes.