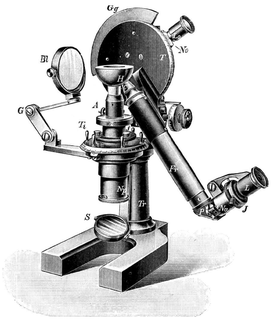
SILFURBERG Í TILRAUNUM OG TÆKJUM

EFNAFRÆÐI, BERGFRÆÐI OG LÍFFRÆÐI

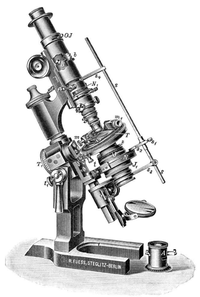
ICELAND SPAR IN EXPERIMENTS AND EQUIPMENTS

CHEMISTRY, MINERALOGY AND BIOLOGY

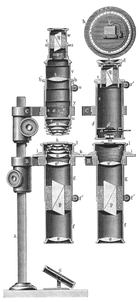


Endurvarpsmælir (Totalreflektometer) til rannsókna á ljóseiginleikum lítilla kristalla sem settir eru á hálfkúluna H. Np og Na eru Nicol-prismu. Tækið var fundið upp af C. Klein 1902 og framleitt af R. Fuess.
A total-reflection instrument for research on the optical properties of small crystals placed on the glass hemisphere H. Np and Na are Nicol prisms. The instrument was invented by C. Klein in 1902 and produced by R. Fuess.
Duparc & Pearce, 1907

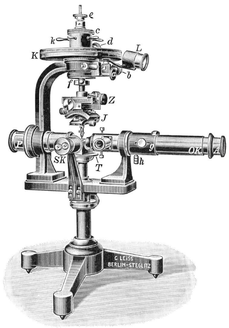
Einföld bergfræðismásjá (microscope polarisant) frá A. Nachet, París, hönnun frá um 1900.
A simple petrographic microscope from A. Nachet, Paris, with two Nicol prisms, designed around 1900.
Duparc & Pearce, 1907



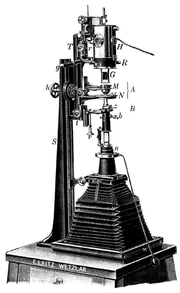
Bergfræðismásjá (Polarisationsmikroskop) með veltiborði. Nicol-prismun í N og N1 valda því að hinar ýmsu steindir bergsins í þunnsneið á borðinu sjást í mismunandi litum. Með aukabúnaði má mæla ljósbrots-eiginleika steindanna. Hönnuð af V. de Souza-Brandao 1903 og seld af R. Fuess frá 1910.
Polarizing microscope from 1903 with a so-called universal stage for advanced mineralogical research on thin-section slides of rock. The Nicol prisms N and N1 cause the different mineral grains in a slide to appear in different colors. With auxiliary components, detailed measurements of optical properties can be made.
Johannsen, 1914



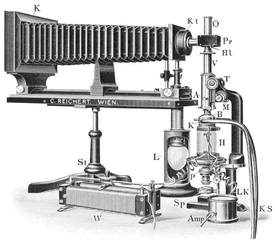
Þversnið af skautunarmásjá (Polarisationsmikroskop) frá 1871, til að skoða gegnsæjar þunnsneiðar af bergsýnum sem lagðar eru á k. P og Q eru Nicol-prismu. Hægra megin er breytt gerð másjárinnar (Stauroskop) til mælinga á ljósbroti einstakra steindakorna. Þar er sérstök plata m úr silfurbergi ofan við sýnið.
A cross-section of an early (1871) type of polarizing microscope, for observations on transparent thin sections of rocks placed above k. P and Q are Nicol-prisms. The right-hand side shows the same microscope, modified for the study of individual mineral grains. In this case a special plate m of Iceland spar is inserted above the specimen.
Groth, 1885



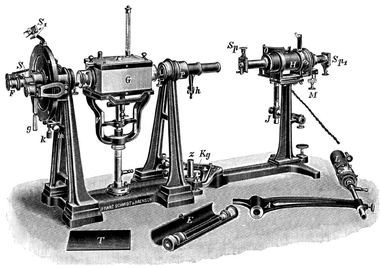
Tæki (Achsenwinkelapparat) til rannsókna á ljósbrotseiginleikum kristalla, sem settir eru í miðju tækisins. Út frá þeim eiginleikum mátti m.a. greina kristallana til tegunda og í mörgum tilfellum áætla efnasamsetningu þeirra. P og A eru Nicol-prismu. Tækið er fundið upp af E. Wülfing 1893 og smíðað af C. Leiss, útfærsla tækisins á myndinni er frá 1898.
An instrument for measuring the angle between the two "optic axes" in certain classes of crystals; its magnitude is of diagnostic value in mineralogical research. P and A are Nicol-prisms. This instrument was invented by E. Wülfing 1893 and produced by C. Leiss, the model in the picture is from 1898.
Leiss, 1925



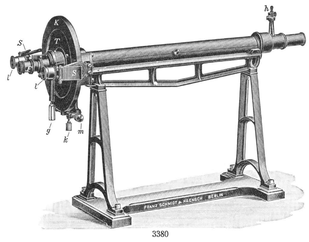
Bergfræðismásjá með belgmyndavél frá E. Leitz. Stækkunartæki var notað fyrir sýnikennslu, teikningar og ljósmyndun varðandi útbreiðslu ljóss í kristöllum. Silfurbergsprismu eru við R og N. Hönnun frá 1910-13.
An enlarger for demonstrations, drawing and photography of optical phenomena in crystals. Iceland spar prisms are at R and N. Design from 1910-13.
Berek, 1913



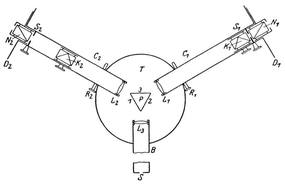
Smásjá (Kristallisationsmikroskop) með Nicol-prismum, hönnuð 1909. Notuð til rannsókna, t.d. á svonefndum fljótandi kristöllum, kristöllun efna úr lausn, bráðnun, eða öðrum áhrifum hitabreytinga. H er rafmagnsofn utan um sýnin, K er myndavél. Tækið er frá C. Reichert í Wien, hannað af C. Doelter um 1909.
A microscope with Nicol prisms, specially adapted with an electrical heater H for observations on liquid crystals, melting of solids, deposition of crystals from solution, and other thermal processes. Design from 1909. K is a photographic camera.
Weinschenk, 1925



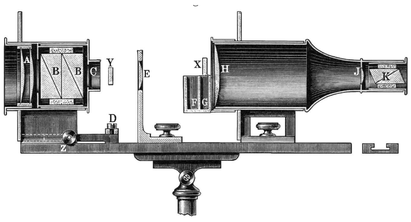
Stór ljóssnúningsmælir með hitabaði frá Schmidt & Haensch með tveimur Nicol-prismum til rannsókna á snúningi skautunarstefnu í lífrænum vökvum. Í þessu afbrigði mælanna er sérstakur hitunarbúnaður G utan um glerrörið með vökvanum, svo hægt sé að gera t.d. rannsóknir á efnaferlum við mismunandi hitastig. Hönnun frá 1895.
A polarimeter with two Nicol prisms for research on the optical properties of organic liquids. This type of polarimeter features a heater G around the sample tube, allowing measurements to be made e.g. of chemical reaction rates at different temperatures. Design from 1895.
Wien-Harms, 1928



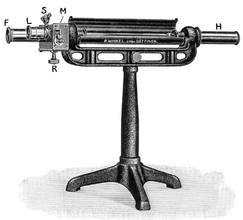
Nákvæmur ljóssnúningsmælir (Halbschattenpolarimeter) frá Schmidt & Haensch til rannsóknastofu-mælinga á margskonar lífrænum vökvum, svo sem jurtaolíum eða lausnum sykurefna og alkaloida. Hönnun frá 1885, með tveimur venjulegum Nicol-prismum og einu litlu.
An accurate half-shade polarimeter for laboratory measurements of optical rotation in organic liquids, such as essential oils or solutions of sugars, alkaloids etc. This instrument, designed around 1885, contains two standard Nicol prisms made from Iceland spar, and one small one.
Struers, 1925



Sjónprófunartæki fundið upp af H.v. Helmholtz, endurbætt af A. König og selt af Schmidt & Haensch frá um 1893. Með Nicol-prismum, silfurbergsstrendingum og kvarzplötum má framleiða allskyns litasamsetningar úr hvítu ljósi. Svipuð tæki voru víða notuð, m.a. til prófana á litaskynjun og litblindu, fyrst 1848. Horft er frá S.
An infinite variety of composite colors may be produced from white light by transmission through Iceland spar prisms and quartz plates. This was widely used for the testing of visual perception and color blindness, beginning in 1848. One such instrument was invented by H.v. Helmholtz; an improved version shown here schematically was presented to him on his 70th birthday in 1891. S: subject.
Wien-Harms, 1928



Sýningarvél fyrir ljósfyrirbrigði í kristalplötum sem settar eru við X eða Y. Ljósið kemur frá vinstri gegnum tvo stóra silfurbergsstrendinga, greiniprismað K er einnig úr silfurbergi. Tækið var smíðað af J. Duboscq um 1875.
Projector for demonstrating crystal optics, c. 1875. Crystal plates may be placed at X or Y. Light comes from the left through two large pieces of Iceland spar; the analyzing prism K is also made from that material. The tool was built by J. Duboscque around 1875.
Verdet-Exner,1887



Einfaldur ljóssnúningsmælir frá R. Winkel-firmanu í Göttingen með Jellett-Cornu hálfskuggaprisma úr silfurbergi, kvarzfleyg og venjulegu Nicol-prisma. Hönnun frá um 1875, einkum til mælinga í styrk sykurlausna í iðnaði: glerrör með þeim eru sett í lárétta hólfið í miðju.
A simple polarimeter employing a Jellett-Cornu half-shadow prism from Iceland spar, a quartz wedge and an ordinary Nicol prism. Design from around 1875, used primarily for measuring the concentration of solutions in the sugar industry. A long horizontal glass tube in the central compartment contains the sample to be studied.
Winkel, 1925

Heimildir / References:

becquerel, e., 1861. Recherches sur divers effets lumineux qui résultent de l'action de la lumière sur les corps.Quatrième mémoire: Intensité de la lumière émise. Ann. Chim. 62, 5-100.
berek, m., 1913. Mineralogisches Demonstrationsapparat. Centralbl. Mineral. 1913, 181-189.
duparc, l. & pearce, f., 1907. Traité de Technique Minéralogique et Pétrographique, I. Vaut & Co. Leipzig, 483 bls.
groth, p., 1885. Physikalische Krystallographie, 2. og 4. útg. W. Engelmann, Leipzig, 770 og 811 bls.
johannsen, a., 1914. Manual of Petrography: Methods. McGraw-Hill, New York, 640 bls.
kristjánsson, l., 2007. Silfurberg: Skýrsla um áhrif þess í rauntvíbrotum. Ónsvr útgáfa fjölritaðrar skýrslu: RH-19-2007. "Silfurberg og þátttur þess í þróun raunvísinda og tæknisar tækni, einkum á 19. öld: minnisblöð og heimildaskrá", nóv. 2007, 384 bls.
kristjánsson, l., 2010. Iceland spar and its influence on the development of science & Technology in the period 1780-1930. Notes and References.
leiss, c., 1925. Die modernen Messinstrumenten der Kristallographien und Petrographien. Séprent úr Fortschr. Mineral. Kristallogr. Petrol. 10, 5-88. G. Fischer, Jena, 91 bls.
struers, h., 1925. Struers Chemisk Laboratorium. Hovedprislist over Instrumenter og Apparater. Kaufmannshøn, 448 bls.
verdet-exner, 1887. Vorlesungen Über die Wellentheorie des Lichtes II. Petta er þýðing E. Exners á Leçons d'Optique Physique II (útg. 1870) með talsverðum viðbótum þýðandans. F. Viewig und Sohn, Braunschweig, 528 bls.
weinschenk, e., 1925. Das Polarisationsmikroskop. 5.ós. útg., aukin af J. Stiny. Herder, Freiburg, 159 bls.
wien-harms, 1928. Handbuch der Experimentalphysik, Band 18: Wellenoptik und Polarisation. Akademische Verlagsgesellschaft, Leipzig, 674 bls.
winkel, r., 1925. Halbschatten-Polarisations-Apparate 1925, Preisliste.

Leó Kristjánsson

Breiðdalssetur – Málvísindi – Jarðfræði – Sagan
Fjarðabyggð
Menningarráð Austurlands
Sóknaráætlun Austurlands
Háskóli Íslands
Náttúrustofa Austurlands
Náttúrustofa Suðausturlands

Grafík Hönnun: Zdenek Pavlík

SILFURBERG Í TILRAUNUM OG TÆKJUM

EÐLISFRÆÐI OG STJÖRNUFRÆÐI

ICELAND SPAR IN EXPERIMENTS AND TOOLS

PHYSICS AND ASTRONOMY

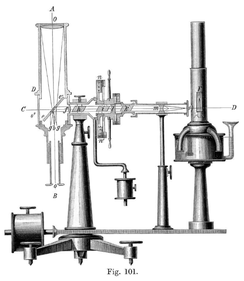
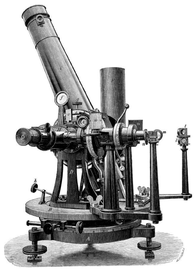
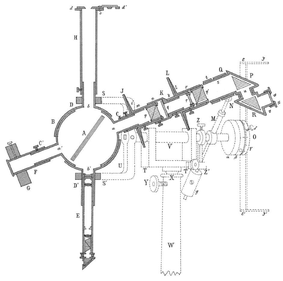


Fig. 101.

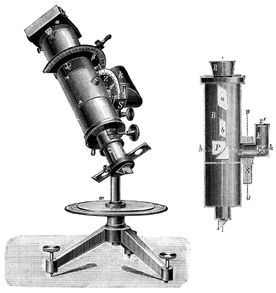
Þversnið af tæki til mælinga á styrk ljóss frá stjörnum, sem F. Zöllner hannaði um 1860. Athugandi við B ber saman ljós frá stjörnu og frá gaslampa í strompinum, með hjálp Nicol-prismanna h og i. Þriðja Nicol-prismað ásamt kvarsplötu leiðréttir fyrir lit stjörnunnar.
Cross-section of the astrophotometer designed by F. Zöllner around 1860. An observer at B compares the light intensity from a star with that from a standard gaslamp in the chimney, attenuated using the Nicol prisms h and i. A third Nicol prism helps to compensate for the color of the star.
Zollner, 1865



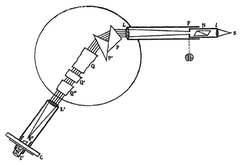
Sjónauki með ljósmæli Zöllners úr myndinni til vinstri, smíðaður um 1890 á að giska. Tæki af þessari gerð (og svipaðir mælar E.C. Pickerings) voru í notkun í mörgum stjörnustöðvum í áratugi við mælingar á birtustigi þúsunda stjarna.
An observatory telescope c. 1890, incorporating Zöllner's astrophotometer. These instruments (and similar ones invented by E.C. Pickering) were used for decades at many observatories for measuring the magnitudes of thousands of stars.
Newcomb-Engelmann, 1921



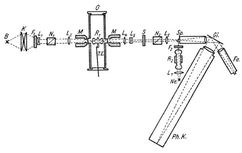
Þverskurður í gegnum tæki nefnt „uranophotometer" til rannsókna á ljósinu frá himninum. Tæki með þremur silfurbergsprismum og sérstakri silfurbergsþynnu (Savart-Platte) til að mæla styrk og skautunarástand himinljóss. Hannað og smíðað af H. Wild í Rússlandi 1875-76.
Cross-section of an instrument named "uranophotometer" by its inventor, H. Wild in 1875/76, containing three Iceland spar prisms and a special plate of that material. It was used for measuring the intensity and state of polarization of skylight.
Wild, 1976



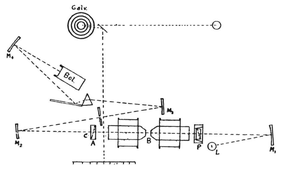
Ljósmælir til ýmissa nota, m.a. mælinga á styrk ljóssins frá himninum. Mælirinn er fundinn upp af L. Weber 1891.
A smaller and simpler instrument for the same purpose, invented by L. Weber 1891.
Busch & Jensen, 1911



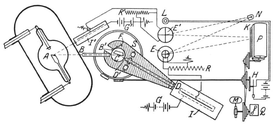
Tilraun E. Mascarts 1872 til að finna áhrif hreyfingar jarðar á snúning skautunarplans ljóss í kvarzplötunum QQ'Q". N1 og N2 eru Nicol-prismu. Samskonar tilraun var gerð með meiri nákvæmni af Rayleigh 1902.
The experiment of E. Mascart 1872, looking for effects of the Earth's movements on the rotation of the plane of polarization within the quartz plates QQ'Q". N1 and N2 are Nicol prisms. A similar more accurate experiment was carried out by Lord Rayleigh in 1902.
Mascart, 1872, 1874



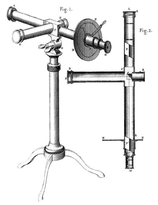
Dæmigerð eðlisfræðitilraun eftir R. Minkowski sem sýnir svonefnd Faraday-hrif (snúning skautunarstefnu ljóss í segulsviði) í natríumgufu í ofninum O. N1 og N2 eru Nicolprismu, S er svonefnd Savart-plata úr silfurbergi.
A typical experiment in optics, set up by R. Minkowski in 1921 to test the absorption of polarized light by hot metal vapor within the furnace O, in a magnetic field. N1 and N2 are Nicol prisms, S is a plate of Iceland spar.
Minkowski, 1921



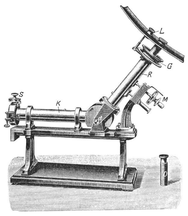
Tilraun L.H. Ingersolls 1917 um áhrif segulsviðs á innrautt ljós í kvarz-sýnum inni í sterkum rafsegli B, dæmigerð fyrir margar slíkar. P og A eru silfurbergsprismu. Tilraunin mælir einnig Faraday-hrif á þá geislun í segulsviði.
The experiment of L.H. Ingersoll in 1917, measuring the effect of a magnetic field on the transmission of infrared light through a quartz specimen. This is a typical investigation on the many aspects of the interaction of light and matter. P and A are Iceland spar prisms.
Ingersoll, 1917



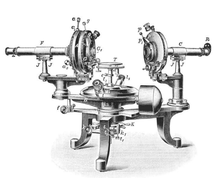
Tilraun A.H. Comptons 1923 um árekstra röntgengeisla við efni. Mældar eru bylgjulengdir röntgengeisla sem verða til við A og endurkastast frá kristallinum C, gjarnan silfurbergi. Styrkur geislanna er mældur í jónunarklefanum I.
A.H. Compton's equipment c. 1920 for accurate measurements on the wavelengths of X-rays generated at A and reflected from the crystal C, often Iceland spar. The intensity of the rays is measured in the ionization chamber I.
Siegbahn, 1924



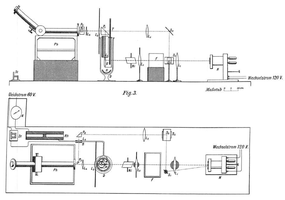
Ljósmælir frá 1861, ein fyrsta gerð slíkra mæla með Nicol-prismum. Edmond Becquerel kannaði flúrljómun silfurbergs, úran-salta og fleiri efna með þessu tæki. Henri sonur hans hélt rannsóknunum áfram síðar, og uppgötvaði þá geislavirkni úrans af tilviljun 1896.
Edmond Becquerel's photometer, described in 1861, was one of the first of such instruments incorporating Nicol prisms. Among other things he studied fluorescence phenomena in various materials including Iceland spar and uranium salts. His son Henri discovered radioactivity in 1896 when continuing these studies.
Becquerel, 1861



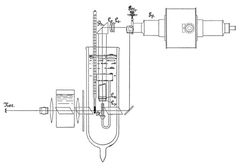
König-Martens litrófs-ljósmælir, uppfundinn af F.F. Martens 1903 og fjöldaframleiddur í áratugi af Schmidt & Haensch til nota í allskyns rannsóknum og iðnaði. Ljósgeislum sem koma frá vinstri er tvístrað með glerprisma í beygjunni, og hlutfallslegur styrkur geislanna er síðan mældur með hjálp Wollaston- og Nicolprisma úr silfurbergi.
The König-Martens spectrophotometer was developed around 1900 and produced commercially for decades. A light beam coming from the left is dispersed by a glass prism at the bend, and the relative intensity of the various colors is measured using a Nicol prism and a Wollaston prism, both of Iceland spar. The instrument found wide use in research and industry.
Weigert, 1927



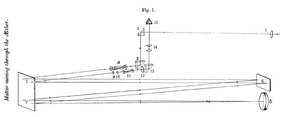
Polarisations-Spektrometer, vandað tæki til mælinga á skautunarástandi ljóss af mismunandi bylgjulengdum, hannað 1905. Ljós kemur frá hægri í gegnum Nicol-prisma í P, og skautunarástand þess er greint með Nicol-prisma í A, glerprisma eða með öðrum tilraunabúnaði sem er á pallinum T.
A high-quality spectrometer, equipped for the analysis of the state of polarization of light of various wavelengths. A light beam enters from the right through a Nicol-prism in P, and is analysed with the aid of another such prism at A. The platform T is for carrying a glass prism, or samples to be tested. Designed in 1905.
Fuess, 1910



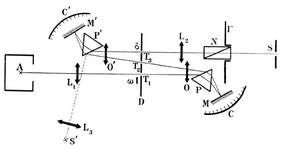
Tilraun R. Fürths 1915 sem staðfesti í meginatriðum kenningu Einsteins 1910 um dreifingu ljóss í vökvum og vökvablöndum. Kenningin var endurbætt af öðrum upp úr 1920. Ni er Nicol-prisma, og Ph er König-Martens ljósmælir með Nicol-prismum.
The experiment by R. Fürth in 1915 which confirmed broadly the 1910 theory of A. Einstein on light scattering in liquids and liquid mixtures. The theory was improved by others in the early 1920's. Ni is a Nicol prism and Ph is a König-Martens photometer with two Iceland spar prisms.
Fuerth, 1915



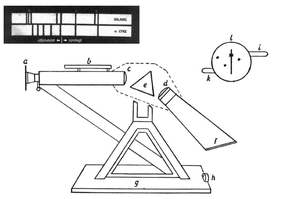
Mælingar H.K. Onnes og W.H.Keesom á ljósdreifingu frá etylen-gufu (Streuung) nálægt kritisku hitastigi gufunnar. Þar sjást þrjú Nicol-prismu. Tilraunin var gerð árið 1908. Albert Einstein skrifaði mikilvæga fræðigrein um þetta málefni 1910.
A setup by H. Kamerlingh Onnes and W.H. Keesom in 1908 for measuring the scattering of light by a liquid near its critical temperature. Three Nicol prisms are seen. Albert Einstein wrote an important paper on the subject in 1910.
Kamerlingh Onnes & Keesom, 1908



Tilraun D.B. Braces 1905 til að finna hreyfingu jarðar miðað við ljósvakann. Hún er sögð hafa verið 300-falt nærmari en tilraun A. Michelsons og E. Morleys 1887 í sama skyni. Hlutirnir 4 og 11 eru Nicol-prismu. Allt kerfið er í 4 m löngu vatnstrogi.
Experimental arrangement by D.B. Brace in 1904, for the detection of the Earth's movement relative to the luminiferous aether. It is said to have been 300 times more sensitive than the well-known 1887 Michelson-Morley experiment for the same purpose. The components numbered 4 and 11 are Nicol-prisms. The entire experiment is submerged in a 4-m long water-filled trough.
Brace, 1905



Tilraun varðandi skautunarstefnu í útfjólublái ljósi á þróngu bylgjulengdabili (monochromateur), sem lýst er af G. Bruhat og M. Pauthenier 1927. A er kvikasilfurslampi og N er Nicol-prisma úr silfurbergi. Þrismun P, P' voru úr kvarzi eða silfurbergi í rannsóknum af þessu tagi, linsurnar L1OO'L2 eru að hluta úr silfurbergi.
Equipment employed by G. Bruhat and M. Pauthenier in 1927 to produce monochromatic ultraviolet radiation. A is a mercury-vapor lamp and N is an Iceland spar prism. The prisms P, P' were usually made from quartz or Iceland spar in this type of research. The lenses L1OO'L2 are partly constructed from Iceland spar.
Bruhat & Pauthenier, 1927



Einföld mynd af stjörnukíkis-litrófsgreini W. Huggins þar sem kvarzlinsur c, d og silfurbergsprisma e komu í stað glerhluta sem gleyptu útfjólublátt ljós. f er ljósmyndaplata. Með tækjum sínum fann Huggins fyrstur manna margar útfjólubláar litrófslínur vetnis 1876. Bylgjulengdir þeirra fylgdu reglubundinni röð sem J.J. Balmer stakk svo upp á formúlu fyrir 1885. Uppgötvunin jók áhuga á litrófsrannsóknum, og hún tengist líkani N. Bohrs 1913 um vetnisfrumeindina út frá skammtakenningum Plancks og Einsteins.
Illustration of W. Huggins' astronomical spectroscope. Quartz lenses c, d and an Iceland spar prism e replace glass components which absorb ultraviolet light. f is a photographic plate. With this equipment, Huggins was the first to observe many of hydrogen's ultraviolet spectral lines in 1876. Their wavelengths evidently followed a regular progression (cf. insert) for which J.J. Balmer suggested a formula in 1885. This discovery increased interest in spectroscopic research, and is connected with N. Bohr's 1913 atomic model based on quantum theories of Planck and Einstein.
Huggins, 1877 & 1880

Heimildir / References:

Becquerel, E., 1861. Recherches sur divers effets lumineux qui résultent de l'action de la lumière sur les corps.Quatrième mémoire: Intensité de la lumière émise. Ann. Chim. 62, 5-100.
Brace, D.B. 1904. On double refraction in matter moving through the æther. Phil. Mag. 7, 317-329.
Bruhat, G. & Pauthenier, M. 1927. Le problème de l'analyse d'une vibration rectiligne ultraviolette. Revue d'Optique 6, 163-184. Extract in C.R. 182, 888-891, 1926.
Busch, F. & Jensen, C., 1911. Tatsachen und Theorien der atmosphärischen Polarisation nebst Anleitung zu Beobachtungen verschiedener Art. 5. Beiheft zum Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten 28, 1910, 532 p.
Fuerth, R., 1915. Spektralphotometrische Untersuchung der Opaleszenz eines binären Flüssigkeitsgemisches. Sitzungsber. Akad. Wiss. Wien 124(IIa), 577-596.
Fuess, R., ~1910. Part of illustrated-catalog (Hauptkatalog) 113 f on spectrometers.
Huggins, W.,1877. Note on the photographic spectra of stars. Proc. Royal Soc. 25, 445-446. Also in Comptes RendusAcad. Sci. Fr. 83, 1229-1230, 1876.
Huggins, W. 1880. The photographic spectra of stars. Phil. Trans. Royal Soc. 171, 669-690.
Kamerlingh Onnes, H. & Keesom, W.H., 1908. On the equation of state of a substance in the neighbourhood of the critical point liquid-gas. II. Proc. Kon. Akad. Wet. Amsterdam 10, 681-623.
Kristjánsson, L., 2007. Silfurberg: Safnsla um áhrif þess í raunvísindum. Ónsur útgáfa fjórðtaðrar útgáfu: RH-19-2007. "Silfurberg og hitt úr þess í þróun raunvísinda og fræðsla tækni, einkum á 19. öld: minnisblöð og heimildaskrá", 384 p.
Kristjánsson, L., 2010. Iceland spar and its influence on the development of science & Technology in the period 1780-1930. Notes and References.
Mascart, E., 1872; 1874. Sur les modifications qu'éprouve la lumière par suite du mouvement de la source lumineuse et du mouvement de l'observateur. Ann. École Normale 1, 157-214 and 3, 363-420. Extract in J. Phys. 4, 129-134, 1875.
Minkowski, R., 1921. Untersuchungen über die magnetische Drehung der Polarisationsebene in nichtleuchtendem Na-Dampf. Ann. Phys. 66, 206-226.
Newcomb-Engelmann, 1921. Populäre Astronomie, 6tn edition by H. Ludendorff. W. Engelmann, Leipzig, 889 p.
Ingersoll, L.R., 1917. Natural and magnetic rotatory dispersion in the infra-red spectrum. Phys. Rev. 9, 257-268.
Weigert, F., 1927. Optische Methoden der Chemie. Akad. Verlagsgesellschaft, Leipzig, 632 + XVI p.
Wild, H., 1876. Photometrische Bestimmung des diffusen Himmelslichtes. Bull., Acad. Impér. Sci. St.-Pétersb. 21, 312-350, continued in 23, 290-305, 1877.
Siegbahn, M., 1924. Spektroskope der Röntgenstrahlen. J. Springer, Berlin, 257 p.
Zöllner, J.K.F., 1865. Photometrische Untersuchungen mit besonderer Rücksicht auf die physische Beschaffenheit der Himmelskörper, Leipzig (1865).

Leó Kristjánsson

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