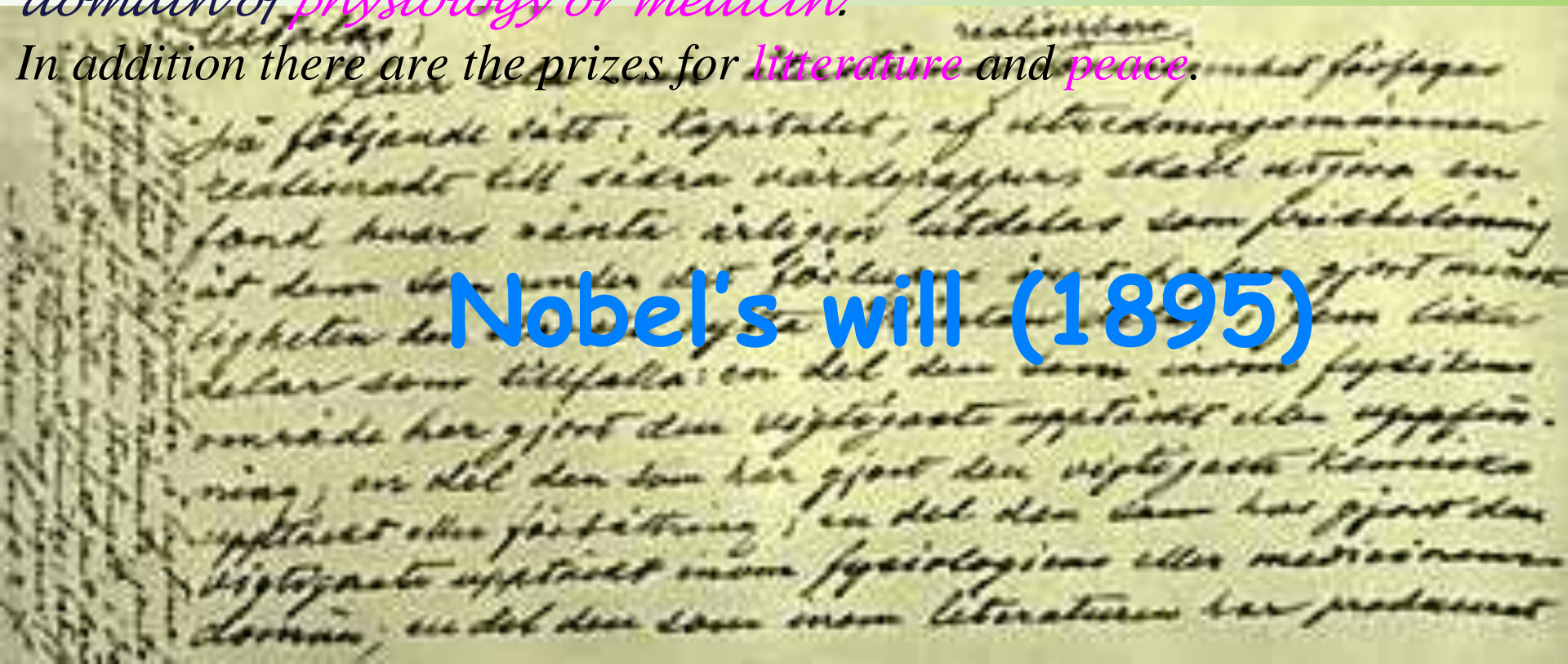
Background to the Nobel Prize to the Braggs

Anders Liljas
Biochemistry and Structural Biology

”The remainder of my fortune should be used in the following way: The Money, should be converted to safe bonds, and form a fund the interest of which annually shall be given as a prize to those who during the past year have made humanity the greatest benefit. The interest is divided in five equal parts, one to be awarded to who in the field of physics has made the most important discovery; one part to who has done the most important chemical discovery or improvement; one part to the person who has made the most important discovery within the domain of physiology or medicin.”

In addition there are the prizes for litterature and peace.



Nobel's will (1895)

Nobel's will created a long legal discussion.

Nobel had lived many years in Russia and had homes in Paris and Italy. The French wanted his money to stay in France.

Neither the French or Italians was enthusiastic about his explosive experiments. Therefore he bought some factories, an artillery shooting ground and a manor house at Karlskoga, Sweden 1893.

The French lawyer who was working with the case found one useful old law paragraph:

"Your home is where your horses are stabled."
Nobel had no horses in Paris or Italy, but three elegant Russian horses in his Swedish stable.

The will obviously had to be executed in Sweden.

The Nobel Foundation

The Royal ScientificAcademy

Karolinska Institute

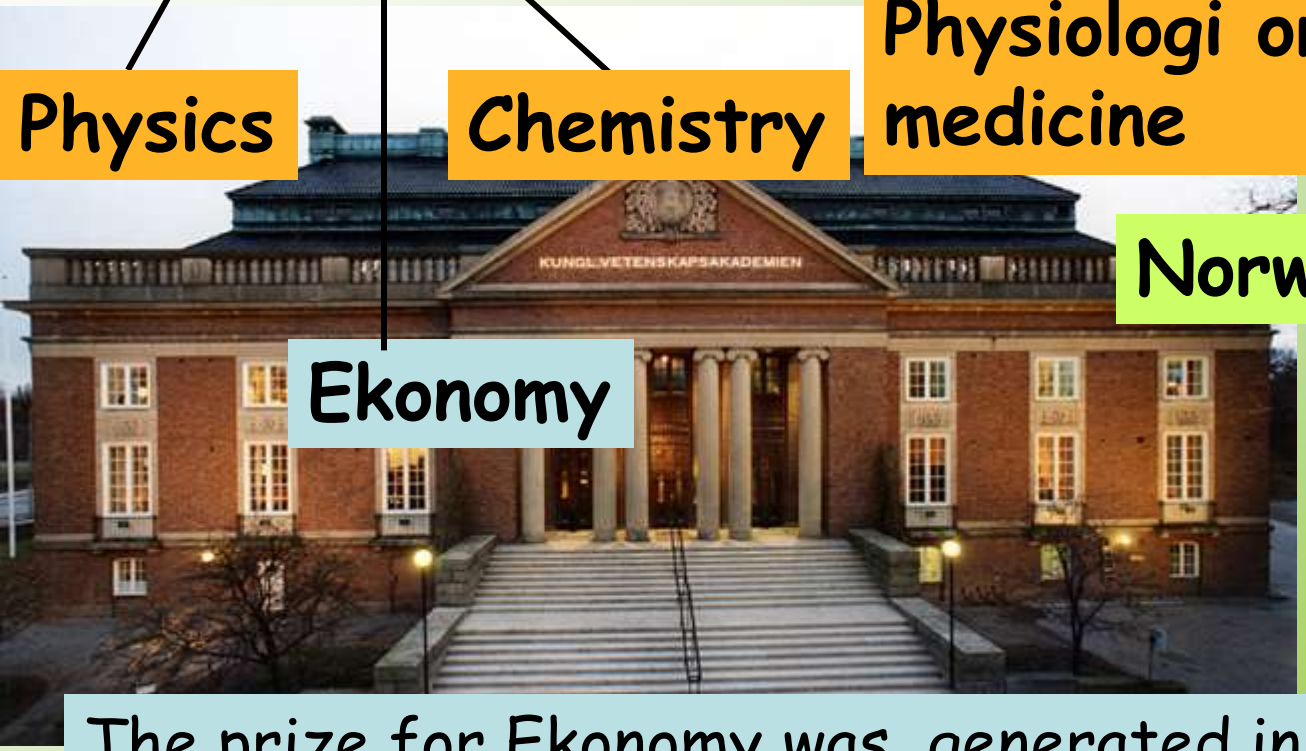
Swedish Academy

Physics

Chemistry

Physiologi or medicine

Litterature



Ekonomy

Norwegian parlament

Peace

The prize for Ekonomy was generated in the 60-ies by the National Bank in the memory of Alfred Nobel

For each prize a
Nobel committee
works to identify a
Nobel laurate

Nobel committees:
Chairperson
4 members
1 or more adjunct members

Meetings about once per month

Who can nominate?

1. The Royal Academy of Sciences
2. The Nobel committees
3. Earlier laurates
4. Nordic professors in chemistry/physics
5. One fifth of the worlds Chemistry departments on a random basis
6. Scientists of unique standing

Friedrich and Knipping, two young coworkers of Sommerfeld, did the experiment, April 21 1912 using copper sulphate. The initial placement of the plate between the X-ray tube and the crystal showed nothing.

von Laue initially thought that the observed diffraction was due to secondary radiation (fluorescence) from the Cu atoms in the crystals.

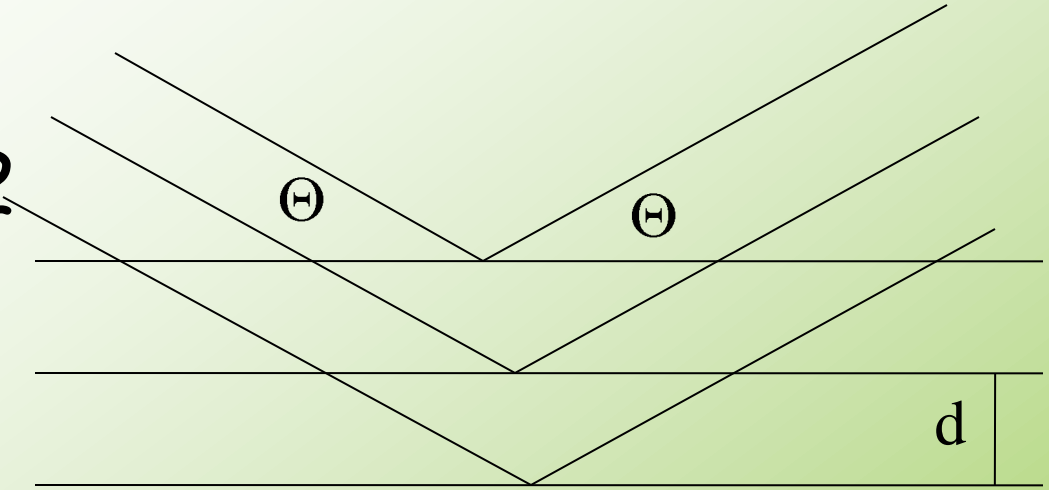
His second attempt was to regard the diffracted beams to be due to five different wavelengths.

The crystals were also assumed to be primitive cubic.

"The men who did the work entirely failed to understand what it meant, and give an explanation which was obviously wrong." (Henry Moseley in a letter to his mother)

Bragg's law, 1912

$$2d \cdot \sin \Theta = n\lambda$$



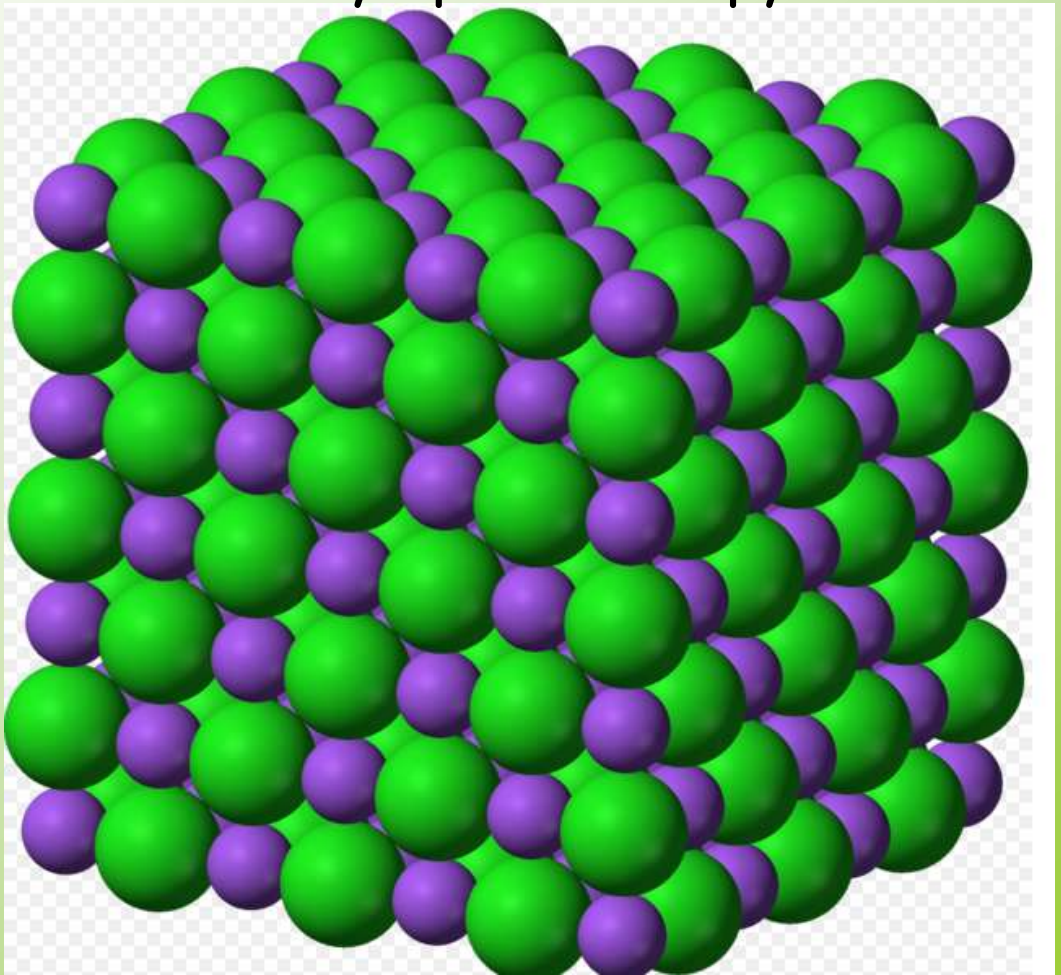
WL Bragg interpreted the photographs by Laue with this simple formula, already used in the analysis of optical diffraction.

von Laue's derivation of the diffraction is essentially the same and so is Ewald's derivation of the "Ewald sphere" 1912.

WH Bragg suggested 1915 that crystals could be represented by Fourier series.

Subsequently **WL** determined the atomic structure of diamond, the alkali metal halides, etc.
Crystals are built of Na+ and Cl- ions rather than NaCl molecules!

WH focused on X-ray spectroscopy



NaCl

Nobel Prizes

The annual process to award Nobel Prizes begins the year before with invitations to nominators.

Nominations should be received at the latest Jananuary 31.

Committee members and invited external reviewers analyze all contributions. By early June the committee summarizes the work of the year.

In September the classes of Physics or Chemistry of the Royal Academy of Sciences, Stockholm, discusses and approves the work of the committee.

In October the whole Academy makes the decision.

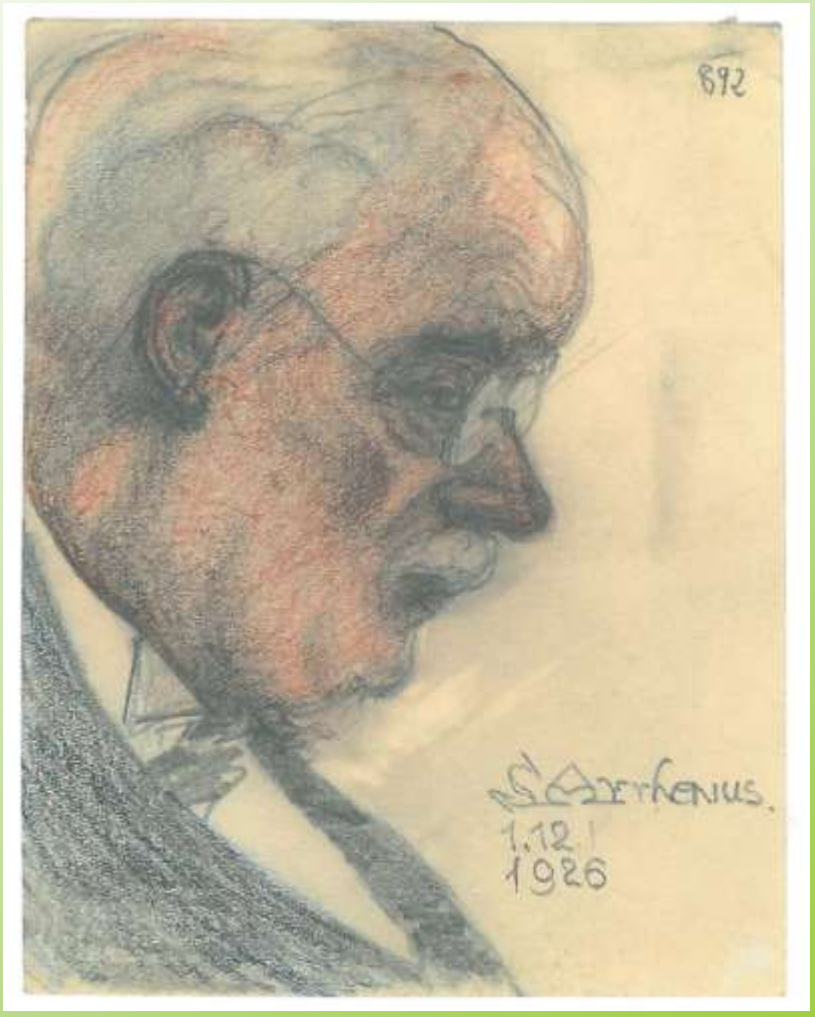
1914

44 nominations of 24 scientists for the Nobel Prize in Physics

Some nominations:
S. Arrhenius (WH Bragg, HGJ Moseley, CG Darwin)
E. Warburg (M v Laue & WH Bragg)
von Bayer (M v Laue)

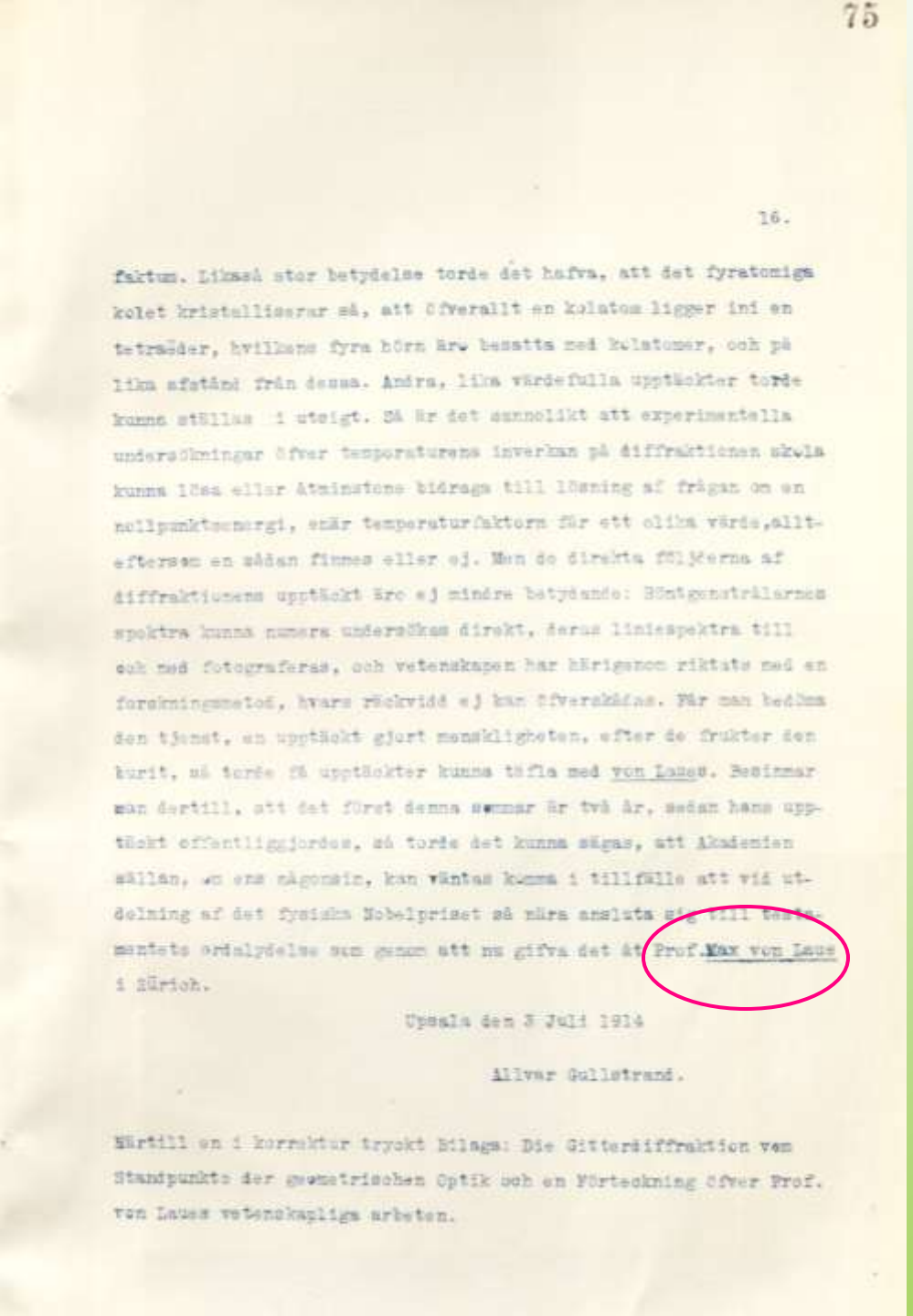
No nomination for WL Bragg!

Allvar Gullstrand was given the task of reviewing the work by von Laue and WH Bragg.



Allvar Gullstrand Svante Arhenius

Two members of the Nobel Committee for Physics



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16.

faktum. Lika stor betydelse torde det hafva, att det fyratomiga kolet kristalliserar så, att öfverallt en kolatom ligger ini en tetraëder, hvilkens fyra hörn äro besatta med kolatomer, och på lika afstånd från dessa. Andra, lika värdefulla upptäckter torde kunna anföras i uteigt. Så är det sannolikt att experimentella undersökningar öfver temperaturens inverkan på diffraktionen skola kunna lösa eller åtminstone bidraga till lösning af frågan om en nollpunktsenergi, emär temperaturfaktorn för ett oliks värde, alltefterson en sådan finnes eller ej. Men de direkta följderna af diffraktionens upptäckt äro ej mindre betydande: Röntgenstrålarnes spektra kunna numera undersökas direkt, derus linjespektra till och med fotograferas, och vetenskapen har härigenom riktats med en forskningsmetod, hvars räckvidd ej kan öfverskådas. För man bedöma den tjenst, en upptäckt gjort mänskligheten, efter de frukter den burit, så torde få upptäckter kunna täfla med von Laues. Besinnar man dertill, att det förut denna sommar är två år, sedan hans upptäckt offentliggjordes, så torde det kunna sägas, att Akademien sällan, om ens någonsin, kan väntas komma i tillfälle att vid utdelning af det fysiska Nobelpriset så nära ansluta sig till testamentets ordalydelse som genom att nu gifva det åt Prof. Max von Laue i Zürich.

Upsala den 3 Juli 1914

Allvar Gullstrand.

Härtill en i korrektur tryckt bilaga: Die Gitterdiffraktion vom Standpunkte der geometrischen Optik och en förteckning öfver Prof. von Laues vetenskapliga arbeten.

A. Gullstrand July 3, 1914: "An award to **WH Bragg** would be inappropriate since **WL Bragg** (not nominated) had made major contributions.

However, it would be unusually close to the intensions of Nobel's will to award Max von Laue just two years after the experiment and its publication".

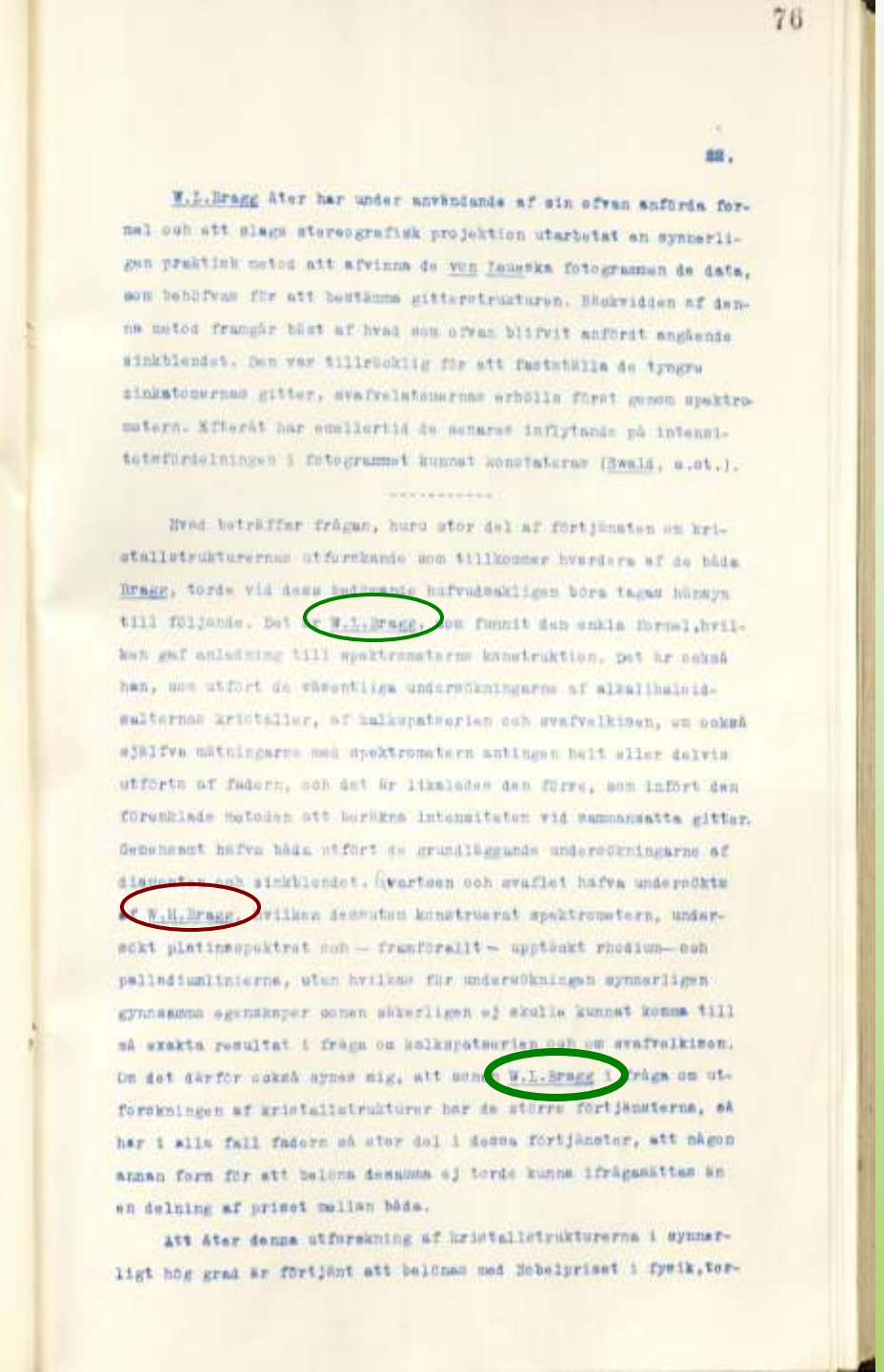
Then World war I began.

1915

17 nominations of 21 scientists for the Nobel Prize in Physics

Some nominations:
S. Arrhenius (WH Bragg, HGJ Moseley, CG Darwin)
TW Richards (**WH Bragg** & **WL Bragg**)
HA Bumstead (M v Laue alone
or with **WH Bragg** and **WL Bragg**)
S Meyer (**WH Bragg**, M von Laue)

Allvar Gullstrand was again given the task of reviewing the field.



76

88.

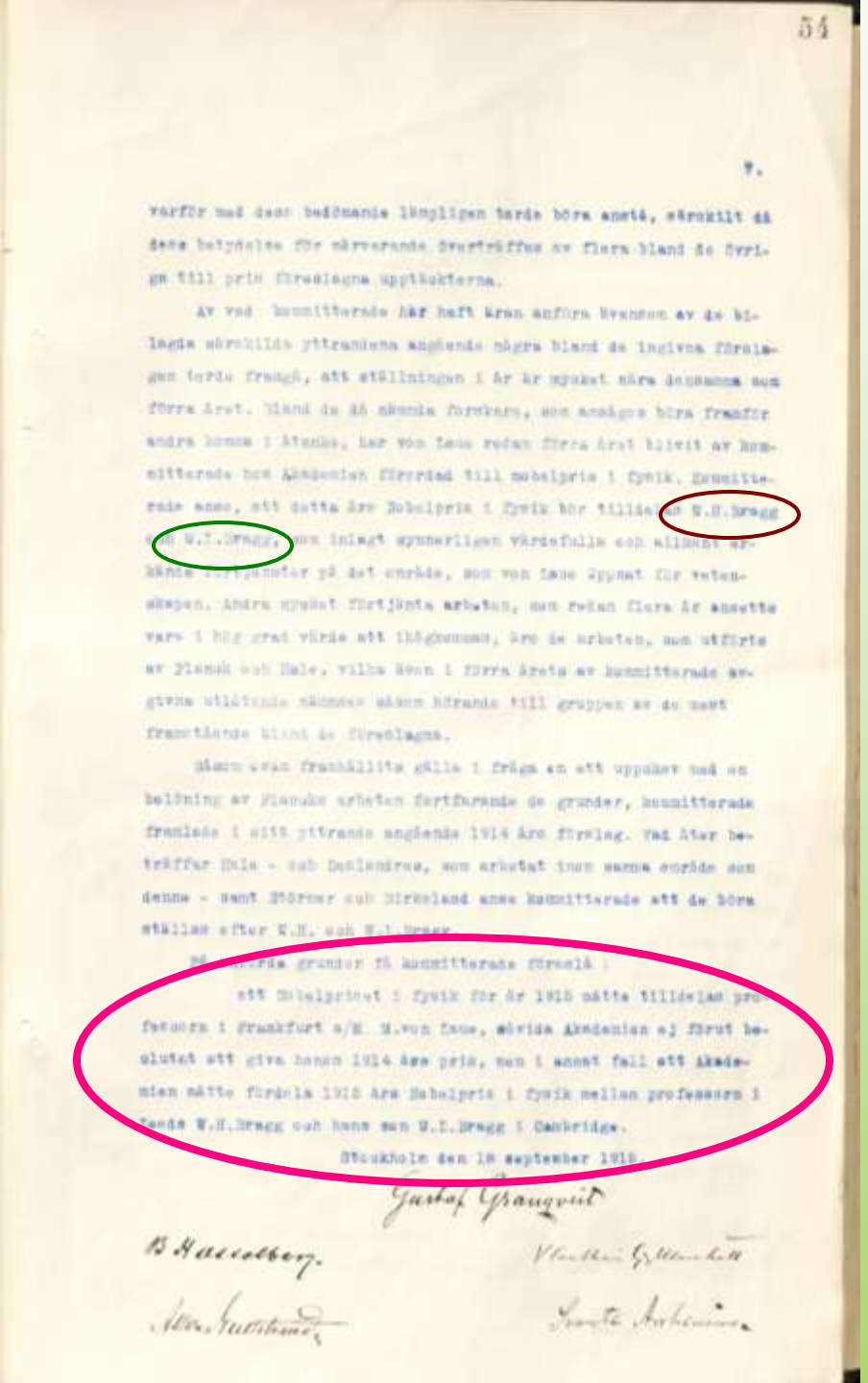
W.L.Bragg åter har under användande af sin ofvan anförda formel och att slags stereografisk projektion utarbetat en synnerligen praktisk metod att afvinna de von Laueska fotogrammen de data, som behöfvas för att bestämma gitterstrukturen. Räckvidden af denna metod framgår bäst af hvad som ofvan blifvit anfördt angående zinkblendet. Den var tillräcklig för att fastställa de tyngre zinkatomernas gitter, svafvelatomernas erhölls först genom spektrometern. Efteråt har emellertid de senares inflytande på intensitetsfördelningen i fotogrammet kunnat konstateras (Ewald, a.st.).

Hvad beträffar frågan, huru stor del af förtjänsten om kristallstrukturernas utforskande som tillkommer hvardera af de båda Bragg, torde vid denna bedömande hufvudsakligen böra tagas hänsyn till följande. Det är W.L.Bragg, som funnit den enkla formel, hvilken gaf anledning till spektrometerns konstruktion. Det är också han, som utfört de väsentliga undersökningarna af alkalihaloidsalternas kristaller, af kalkspatsorien och svafvelkisen, ur också själfva mätningarna med spektrometern antingen helt eller delvis utförts af fadern, och det är likaledes den förre, som infört den förenklade metoden att beräkna intensiteten vid sammansatta gitter. Gemensamt hafva båda utfört de grundläggande undersökningarna af diamanten och zinkblendet. Kvartsen och svavlet hafva undersökts af W.H.Bragg, hvilken dessutom konstruerat spektrometern, undersökt platinaspektrat och — framförallt — upptäckt rhodium- och palladiumlinierna, utan hvilkas för undersökningen synnerligen gynnsamma egenskaper somen säkerligen ej skulle kunnat komma till så exakta resultat i fråga om kalkspatsorien och om svafvelkisen. Om det därför också synes mig, att somen W.L.Bragg i fråga om utforskningen af kristallstrukturer har de större förtjänsterna, så har i alla fall fadern så stor del i denna förtjänster, att någon annan form för att belöna dessamma ej torde kunna ifrågasättas än en delning af priset mellan båda.

Att åter denna utforskning af kristallstrukturerna i synnerligt hög grad är förtjänt att belönas med Nobelpriset i fysik, tor-

Gullstrand made a new extensive review of the field (24 pages).
He came to the conclusion that **WL Bragg** had made remarkable contributions. The formula and the structures gave essential new insights.

However, it would be *wrong* (!) to exclude **WH Bragg** since he had constructed a spectrometer and made novel observations of the spectra.



The decision of the **Physics Nobel Committee** for 1915 was to award M von Laue, unless he was already awarded the Prize for 1914.

Otherwise the Academy should award **WH Bragg**, Leeds jointly with his son **WL Bragg**, Cambridge.

WH and WL Bragg.
Nobel prize in physics 1915

The two Braggs were "greatly honored indeed" by the prize, but the war had stirred the nationalistic sentiments.

WH Bragg could not participate in the ceremony, 1920, with several German laureates. He never came to Stockholm.

WL Bragg also stayed home, but came 1922 to give his Nobel lecture at KTH.

Nov 17, 1915

Tecknet * utmärker punkt, komma, kolon eller semikolon.
„ („ parentes.
„ = mellan helt tal och bråkmärker blandat tal, ex. 6=3/4 betyder 6 3/4.

No. 653.
inkom den 17 nov. 1915.

377.
9

TELEGRAM.

KUNGL. TELEGRAFVERKET.

STOCKHOLM
16 NOV 1915
TELEFONBYRÅN

j346 london 440 18 15nov 3 50s =

aurivellius national academy of sciences sthm

= my son and i are greatly

honoured indeed bragg university college

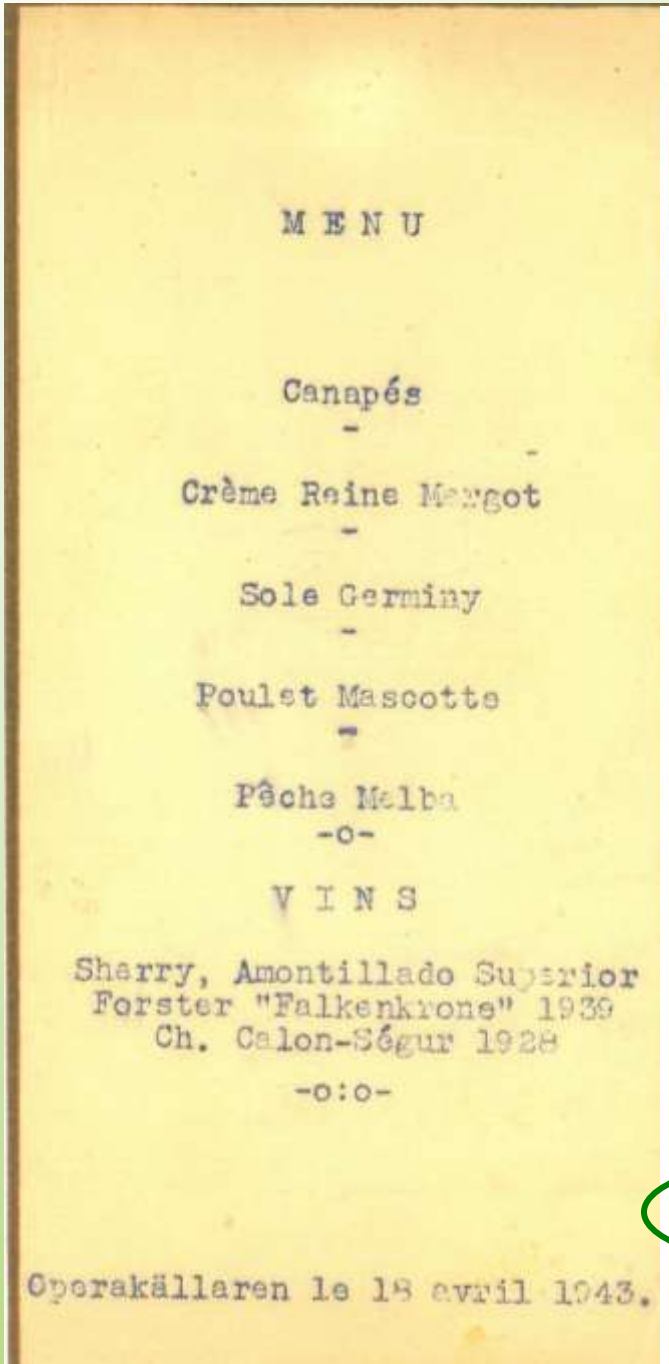
london =

Exp. av

1943

WL Bragg made several visits to Sweden.
During the war he was engaged by the Brittish Council to spread Brittish culture.

He visited Swedish universities and Anglophil societies April 1943.



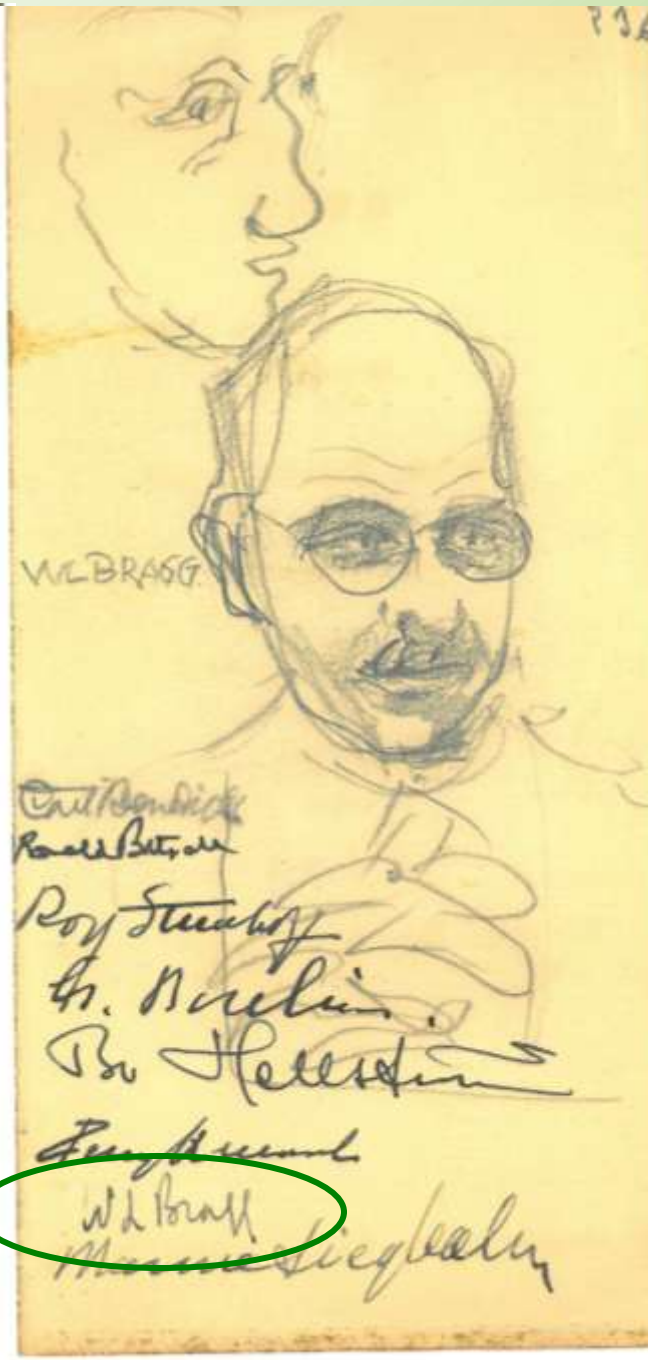
MENU

Canapés
-
Crème Reine Margot
-
Sole Germiny
-
Poulet Mascotte
-
Pêche Melba
-o-
V I N S

Sherry, Amontillado Superior
Forster "Falkenkrone" 1939
Ch. Calon-Ségur 1928

-o:o-

Operakällaren le 18 avril 1943.



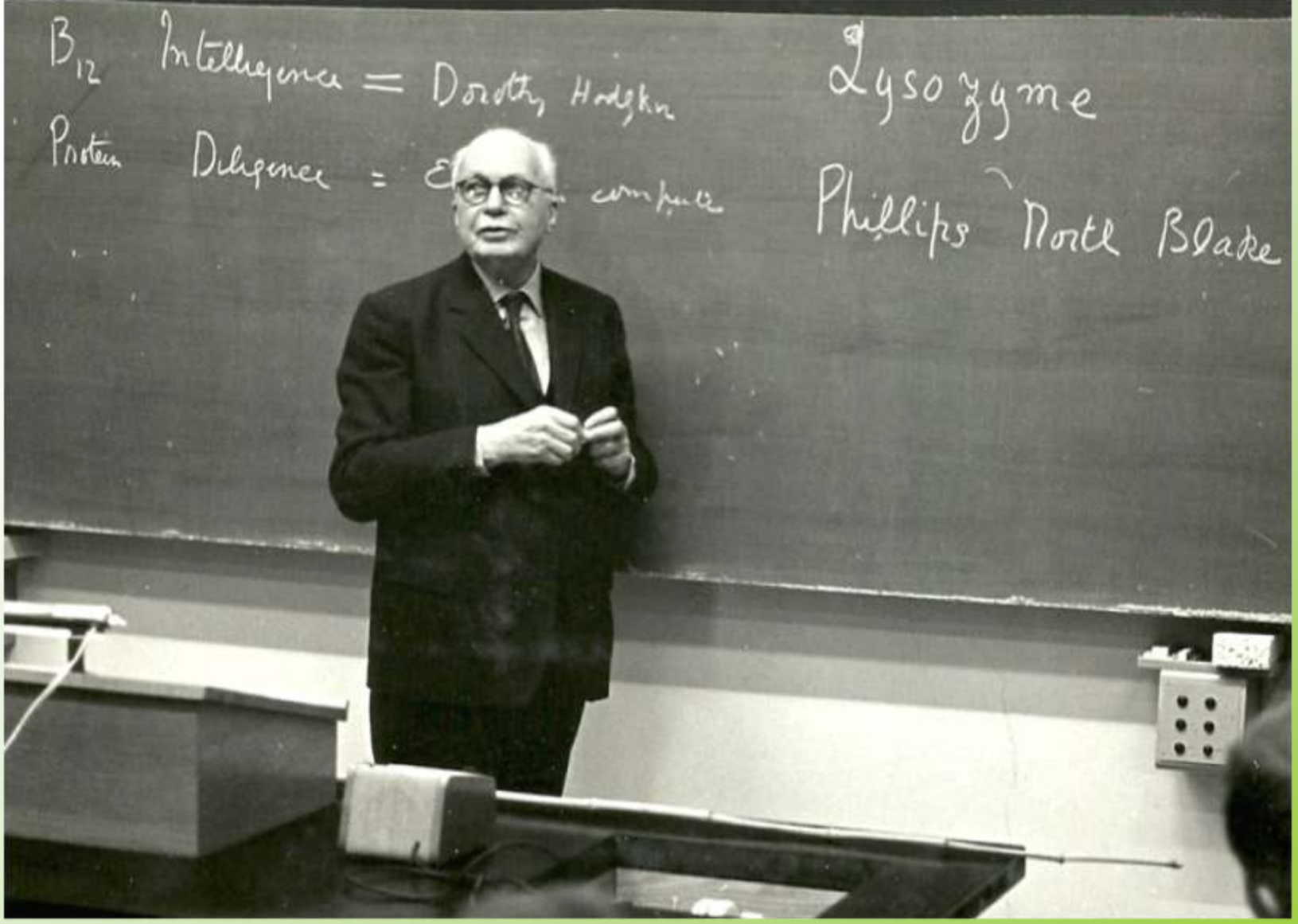
1943

A gathering with the Chemistry professors at Uppsala University, April 22, 1943.
The Svedberg (Nobel laureate in chemistry, 1926), Arne Fredga, Arne Tiselius (Nobel laureate in chemistry, 1948), **WL Bragg**, Gunnar Hägg and Axel Lindh.

1965

WL Bragg explaining the structure of lysozyme to some of the protein crystallographers in Uppsala.

The Nobel Jubilee lecture in Uppsala 1965



The Nobel Jubilee lecture in Uppsala 1965