

The History of Physics in Heidelberg

Starting point: Universitas Ruperto Carola

Founded 1386 as the third university in the 'Holy Roman Empire' after Prag (1348) and Vienna (1365)



The Early Period

1387 first physics lecture: Heilmannus Wunnenberg, 2nd Rector

- based on Aristoteles (Albertus Magnus)
- Physics not considered as a separate discipline, but part of the Faculty of Arts (Fakultät der Artisten) which encompassed theology, law and medicine

1556 permanent physics chair established

- following Philipp Melanchthon, Wittenberg

1593-1604 **Theophilus Maderus** Professor Physices

After 30-year war:

1650-1700 **Johannes Leuneshloss**

Physices et Matheseos Professor

1728-1748 **Bernhard Nebel** Physices et Matheseos Professor

first experiments



The Bibliotheca Palatina

1430 founded by Palatine Elector Ludwig III. location Heilig-Geist-Kirche

1556 Elector Ottheinrich add University library and his private library

1584 Ulrich Fugger wills 86 very precious manuscripts

1600 inventory about 3500 manuscripts, 5000 printed books

1622 30-year War: Troups of the Catholic Lega under Count von Tilly conquer Heidelberg and take the library - 184 boxes - to Maximilian I. of Bayern

Maximilian 'donates' most of the library to pope Gregor XV, from then part of the **Bibliotheca Apostolica Vaticana**

1816 Congress of Vienna decides that pope Pius VII will return most German language manuscripts (852 volumes) to the Heidelberg University Library

1986 for the 600-year anniversary of Ruperto Carola: exhibition of a large number of manuscripts and books in Heilig-Geist-Kirche

1998 Cologne: 67 volumes found in the University and City Library, returned

Role for physics: Aristoteles and other scholastic literature, Kopernikus(?) before 1622, close to none thereafter



De Venandi
cum Avibus

The Beginnings of Physics in Heidelberg



Physics Chair sponsored by the Elector Palatine Karl-Theodor:

1752-1774 **Christian Mayer** (1724-1799), Jesuit (like several after him)

astronomy, binary stars, cartography, mathematics

observatory in Schwetzingen, then Mannheim

1781 Mathematics separated

1817 Chemistry separated

1817 **Georg Wilhelm Muncke** (1772-1847)

1846 **Philipp von Jolly** (1809-1884)

came from 'industry'

practical-minded

1846 Practical Lab Courses

1850 Haus zum Riesen, Hauptstr

first 'Physics Institute'



Philipp von Jolly to Max Planck on Physics as a potential field of study (1874):

„In this field, almost everything is already discovered, and all that remains is to fill a few unimportant holes.“

Planck, at age 16, replied that he didn't wish to discover new things, only to understand the known fundamentals of the field.

The 19th Century Highlights

1854 **Gustav Robert Kirchhoff** (1824-1887)

Spectral analysis together with

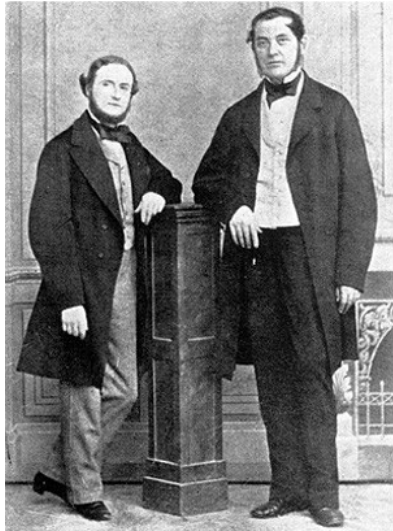
1852 **Wilhelm Bunsen**, Chemistry (1811-1899)

1858 **Hermann Helmholtz** (1821-1894) →

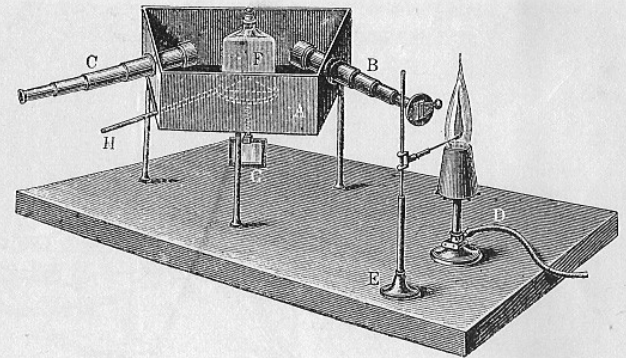
Physiology and physics of eye and ear

1871 Physics chair in Berlin

1863 new Institute in Friedrichs-Bau, Hauptstr



Kirchhoff - Bunsen



1875 **Georg Hermann Quincke** (1834-1924)

Philipp Lenard (1862-1947)

Nobel price 1905

'anode rays': experiments with protons and Hg ions
photoeffect

1907 Physikalisches Institut

1912 new building Philosophenweg 12

'seismic and electrical interferences
with tram in Hauptstrasse'

not much productive physics work in Heidelberg

'Deutsche Physik' [Aryan Physics]:

- Quantum Mechanics and Relativity: 'Jewish theories'
- 1920 Nauheim meeting of the Society of German Scientists and Physicians, 'duel' dispute with Einstein
- renounced his membership in the DPG
- 1924 supports Hitler's Munich Putsch
- „Science like every other human product is racial and conditioned by blood.“

1931 Emeritus, continued political activity



Emil Rupp: a case of Scientific Fraud

1920 doctoral thesis supervised by Lenard

he didn't share Lenards views of 'Jewish physics'

Industry job at AEG

1926 habilitation paper, behind Lenards back:

'Interferenzuntersuchungen an Kanalstrahlen'

Ann. Physik 79 (1926) 1

stimulated discussions, among others with Einstein

doubts started

replications failed (e.g. by W. Wien, Gerlach)

more 'sensational' papers, on interferences, positrons

finally 1935, all papers retracted

ANNALEN DER PHYSIK.

VIERTE FOLGE. BAND 79.

1. *Interferenzuntersuchungen an Kanalstrahlen;* *von E. Rupp.*

(Aus dem Radiologischen Institut der Universität Heidelberg.)¹⁾

Die elektromagnetische Theorie lehrt die Berechnung einer Dämpfungskonstanten des als linearen Oszillator im Atom schwingenden Elektrons vom Betrage

$$2\alpha = \frac{8\pi^2 e^2}{3mc^2} = 5,35 \cdot 10^7 \text{ sec}^{-1} \text{ für } H_\alpha.$$

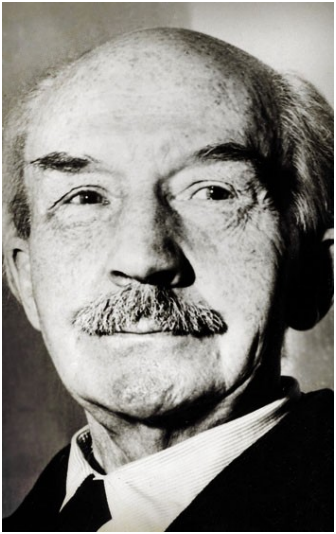
Danach fällt die Amplitude eines Wellenzuges von ihrem Anfangswert A_0 nach dem Gesetz $A = A_0 \cdot e^{-\alpha t}$ zeitlich ab. Der e -te Betrag der Anfangsamplitude wird nach einer bestimmten Zeit, der *Abklingzeit* $t = \frac{1}{\alpha}$ erreicht.

Für das Vorhandensein einer solchen Abklingzeit sprechen auch die Erscheinungen der Interferenz bei hohen Gangunterschieden. Nimmt man an, daß Interferenz nur möglich ist zwischen Wellenzügen, die von ein und demselben Atom ausgesandt werden und daß diese Wellenzüge das Atom mit Lichtgeschwindigkeit verlassen, so gehört zu einer spektroskopisch gemessenen Kohärenzlänge L eine Zeit $t' = \frac{L}{c}$, während der der Wellenzug L vom emittierenden Atom ausgesandt wurde. Im allgemeinen wird $t' < t$ sein, da die Interferenzfähigkeit einer Spektrallinie aus verschiedenen Gründen (Linienstruktur, Apparatunvollkommenheiten) vor Erreichen der Amplitude A_0/e erlischt. Die aus Interferenzbeobachtungen ermittelte Zeit t' kann daher als Mindestabklingzeit angesprochen werden. Die größten mit Sicherheit festgestellten Interferenzweglängen wurden von den Herren Gehrcke und Lummer²⁾ an der grünen Quecksilberlinie $546 \text{ m}\mu$ beobachtet, nämlich 1200000 Wellenlängen entsprechend einem Wegunterschied

1) Heidelberger Habilitationsschrift.

2) E. Gehrcke u. O. Lummer, Verh. d. D. Phys. Ges. 4. S. 337. 1902.

Wather Bothe (1891-1957)



1932 chair at Physikalisches Institut

a patriot, but not a Nazi friend

under attack by 'Deutsche Physik', Gestapo

forced to quit 1933

1934 MPI for Medical Research (founded 1930)

- coincidence method: energy conservation
- nuclear photo effect, man-made isotopes
- 1943 **first cyclotron in Germany**

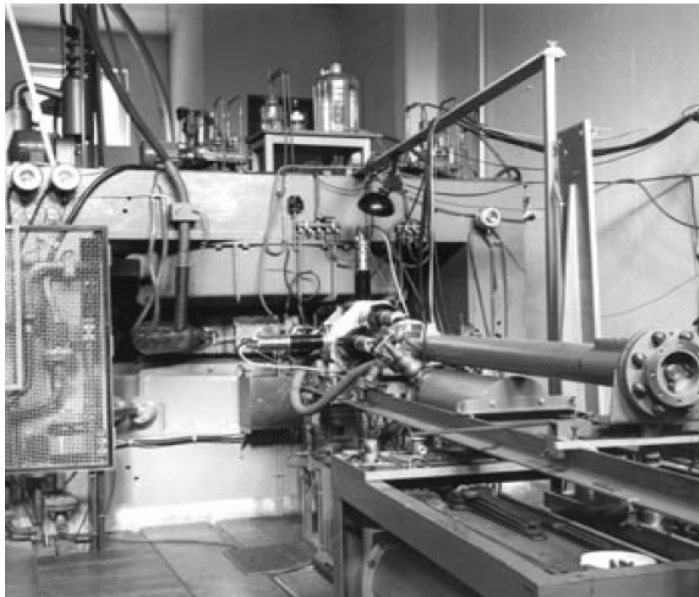
to Albert Speer: „nur für die medizinische und biologische Forschung nützlich“

- 1939 Uran-Verein [Uranium Club]
- fission studies
- neutron reaction cross sections

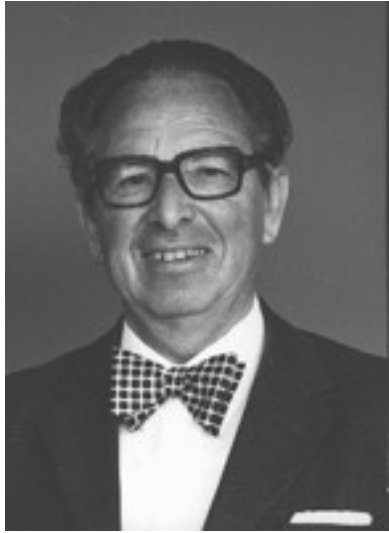
1950 I. Physikalisches Institut (II: Otto Haxel)

1953 MPI restart after war, close collaboration with Phys. Inst.

1954 Nobel price



The 1950s, continued



1950 **Otto Haxel** (1909-1998) II. Phys. Inst.

- nuclear physics experiment and theory
- radioactivity of air
- new field: Environmental Physics
- 1975 IUP (Institute for Environmental Physics)



1953 **Hans Kopfermann** (1895-1963) I. Phys. Inst.

- atomic and nuclear spectroscopy
- betatron
- 'Optical pumping of gases'



Theory in Heidelberg

1949 **Johannes Hans Daniel Jensen** (1907-1973)

- Nuclear Shell Model with
Otto Haxel and Hans. E. Suess
- **Nobel price 1963** with Maria Goeppert-Mayer
- elementary particle, nuclear and solid state theory
- 1956 Institute Philosopenweg 16 'Jensen-Haus'



Christoph Schmelzer (1908-2001)

1948 postdoc with Bothe

- HF, accelerator technology

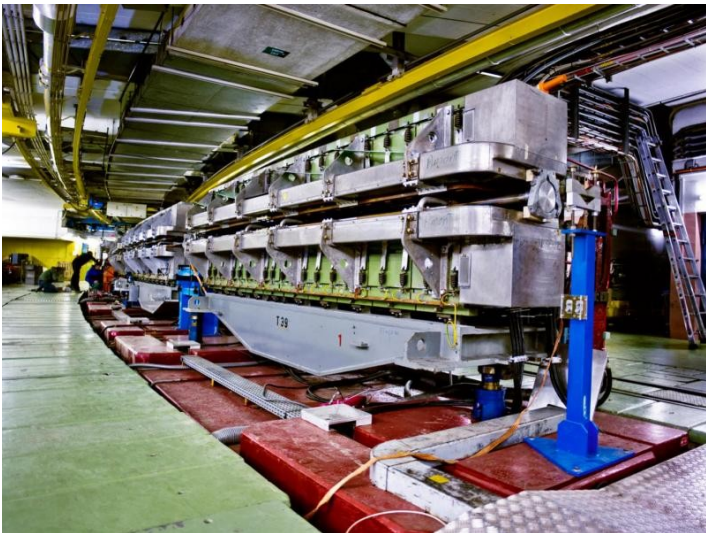
1952 work on CERN PS: HF and control system design

1954 CERN

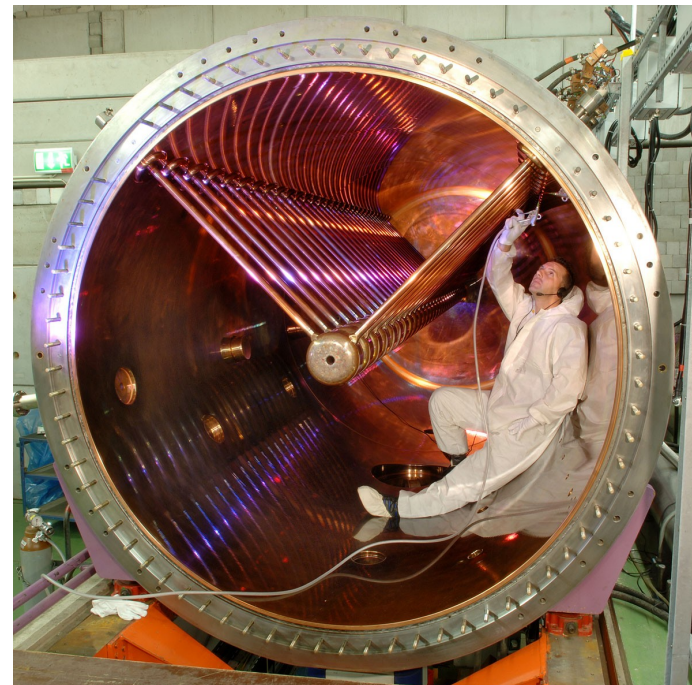
1959 Institute for Applied Physics

1969 proposal of the UNILAC heavy ion accelerator for GSI

1971-78 Technical Director of GSI



PS



UNILAC

What about Present and Future?

The Heidelberg Physics Environment

Institute count

No downcount for fusions, e.g.

Physikalisches Institut

Kirchhoff Institute

ZAH Center for Astronomy Heidelberg

Not included in the graph:

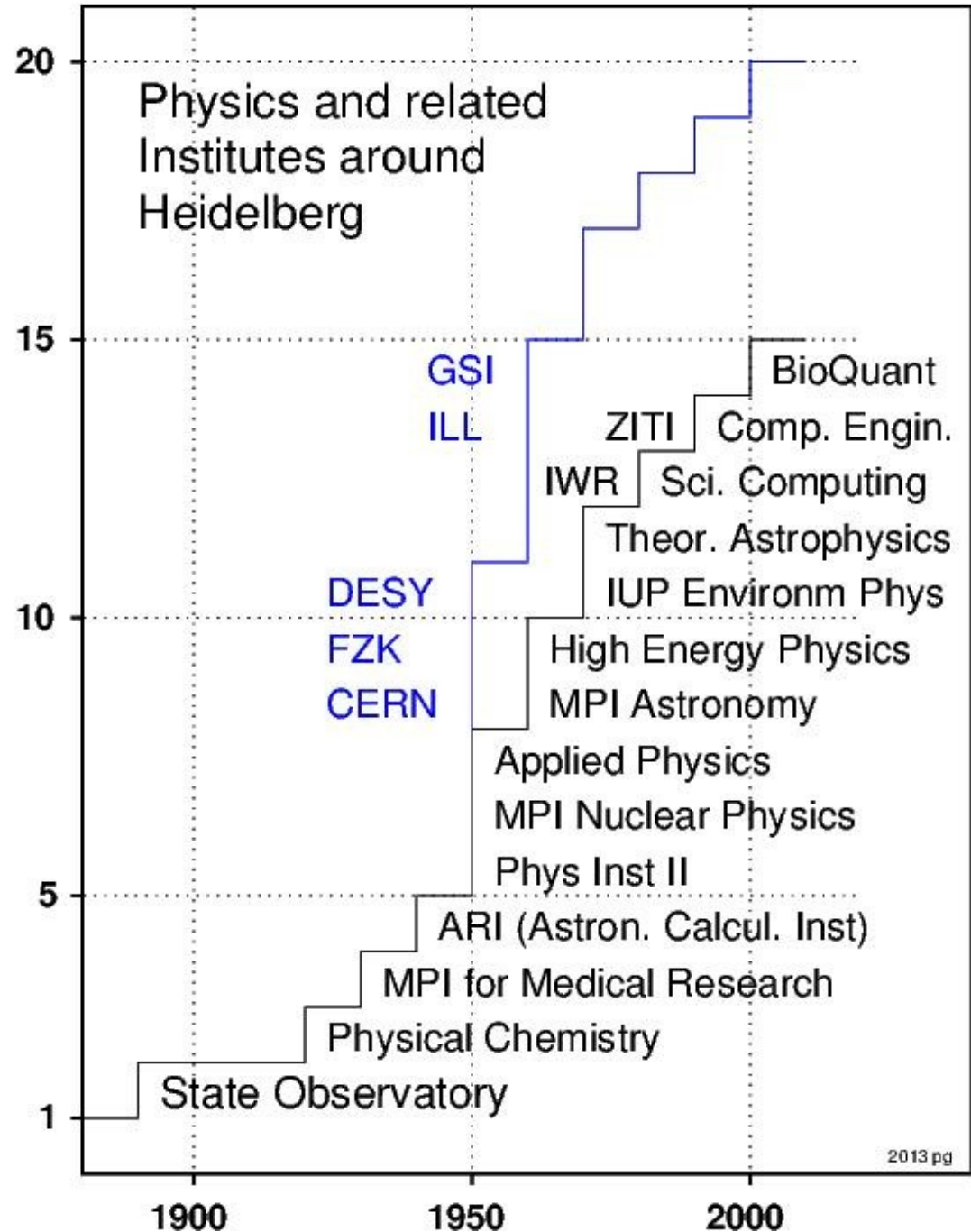
1964 DKFZ
German Cancer Research Center

1974 EMBL
European Molecular Biology Lab

1983 ZMBH
Molecular Biology Center Heidelberg

2003 HIT Heavy-Ion Therapy

Virtual Institutes



It is up to you to continue this success story



References:

600 Jahre Universität Heidelberg, hrsg. vom Rektor, ISBN 3-87455-044-3

www.physik.uni-heidelberg.de/ueberuns/historisches

www.uni-heidelberg.de/universitaet/geschichte/geschichte.html

www.wikipedia.org