The Physics Museum
at UNIL / EPFL

Jean-François LOUDE
Prof. emeritus

http://museephysique.epfl.ch
musee.physique@unil.ch

Swiss Physical Society, Basel, 21 June 2010
1. EXPERIMENTAL PHYSICS AT LAUSANNE

1537 Foundation of the Academy by LL. EE. of Bern, as a School of Protestant Pastors

1776 Experimental Physics is now taught regularly
   First « Cabinet de physique » (collection of instruments for demonstrations)

1869 A private Engineering School founded in 1853 becomes part of the Academy, eventually becoming Ecole Polytechnique (EPUL) in 1946
1882 Creation of an Experimental Physics Laboratory at the Academy
1890 The Academy becomes an University

1950 Foundation of an Experimental Physics Laboratory at EPUL and first « Ingénieur-physicien » diploma
1953 At last more than one single chair of Experimental Physics at UNIL
1969 EPUL becomes EPFL

Strong development of physics at the University and at EPFL

2003 Physics transferred from UNIL to EPFL

WHAT DO WE DO WITH THE OUTDATED INSTRUMENTS BELONGING TO UNIL ?

A permanent exhibition, in short a MUSEUM
II. SCIENTIFIC INVENTORY

- Visit every room, open every cupboard, contact friends
- Accept objects at least 50 years old
- Mainly experimental physics, nuclear physics, physical chemistry, astronomy and surveying
- Apart from microscopes, instruments for exclusive biological/medical use are not inventoried
- Main contributions:
  - Experimental Physics UNIL (≈ 66 %)
  - Others UNIL and Nuclear Physics (≈ 12 %)
  - EPFL (mainly Electricity) (≈ 9 %)
  - Schools (Gymnase de la Cité, Collège de Vevey) (≈ 9 %)
  - Others: donations, loans, purchases (≈ 4 %)

Most electronic instruments are not inventoried. They are documented and stored in a “Purgatory”
INVENTORY : CONTENTS

- Now 863 files, including descriptions, photographs, documentation (example follows)

- Many more objects (lots of thermometers, duplicates, etc.)

- Main categories:
  - Electricity and magnetism (≈ 45 %)
  - Optics (≈ 24 %)

- Origin: mostly German, Swiss, French… and unknown

  Much has been lost! (several removals…)
  But retained instruments generally in good, usable condition!

Typical University collection, with a mixture of instruments for lecture demonstrations, for students laboratories, for research, for professional or industrial use
**Example of inventory file “FileMaker Pro 7” (1st page)**

<table>
<thead>
<tr>
<th>Catégorie</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double sirène de Helmholtz</td>
<td></td>
</tr>
<tr>
<td>No inv.</td>
<td>603.192</td>
</tr>
<tr>
<td>Nbre ex.</td>
<td>1</td>
</tr>
<tr>
<td>Import.</td>
<td>A</td>
</tr>
</tbody>
</table>

**Description**

<table>
<thead>
<tr>
<th>Constructeur</th>
<th>Rudolph Koenig, Paris</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Double sirène de Helmholtz, constituée de 2 sirènes à plusieurs voix de Dove sur le même axe, mises en rotation par de l’air comprimé. Modèle perfectionné et vendu par Rudolph Koenig. Utilisée par Helmholtz, dans les années 1860-1890, pour ses recherches en acoustique physique et physiologique (notamment sur les “Combinations d’onde”). Les sirènes du haut et du bas, à deux orifices, produisent des sons de fréquences différentes, mais avec un rapport précis. Le son, qui est un des plus hauts des ondes sonores produites par les deux sirènes est ajustable. La sirène simple à air comprimé a été inventée en 1819 par Charles Cagniard de la Tour (1776-1859); la sirène à plusieurs voix (plusieurs cercles de trous obstruables à volonté) a été publiée en 1851 par Heinrich Wilhelm Dove (1803-1879).</td>
</tr>
<tr>
<td>Dimensions</td>
<td>450 x 245 x 470 mm³</td>
</tr>
<tr>
<td>Datation</td>
<td>3e quart XIXe s. après 1877 avant 1901</td>
</tr>
<tr>
<td>Etat</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

**Accessoires**

(No inv.)

**Usage principal:**

<table>
<thead>
<tr>
<th>Laboratoire</th>
<th>Enseignement (démos/TP)</th>
</tr>
</thead>
</table>

**Laboratoire**

Pratique professionnelle
En bas : 4 cercles de trous avec 4 tirettes pour ouvrir ou fermer l'admission d'air à chacune d'entre-œux.
Nombre de trous : 8 (à l'intérieur) — 12 — 12 — 18 (à l'extérieur).
En haut, système semblable, mais nombre de trous différent : 9 — 12 — 15 — 16.
Compte-tours 0 à 25 (cadran de droite sur la figure de gauche), incrémenté de 1 au passage à 100 du cadran de gauche.
Réglage de phase de la sirène du haut.
Prix de la sirène double de Koenig : 450 francs.

Sur les expériences réalisables avec la sirène double de Helmholtz, voir Pisko (1865, Kap. 2, S. 48) et Helmholtz (1870, S. 253-261 et Beilage XII) et (1896, S. 268-277 et Beilage XIII). La double sirène que fit construire Helmholtz en Allemagne ressemble beaucoup, mais n’est pas identique à celle de Koenig.

Documents et références bibliographiques

— Dr. Fr. Jos. Pisko: Die neueren Apparate der Akustik Wien 1865
— Catalogues: Koenig, 1873 et 1889.
— H. von HELMHOLTZ: Die Lehre von den TONEMPfindungen als physiologische Grundlage der Theorie der Musik (Braunschweig: Friedrich Vieweg und Sohn 1870).
— H. von HELMHOLTZ: Die Lehre von den TONEMPfindungen als physiologische Grundlage der Theorie der Musik (Braunschweig: Friedrich Vieweg und Sohn 1886).
— FRICHS Physikalische Technik (6. Aufl., 1883), 921 (1895), S. 920, Fig. 991
— J. VIOILLE: Lehrbuch der Resonanz (Berlin, 1893) S. 105, Fig. 53.
— Sur Marloye et Koenig:
III. MUSEUM

13 showcases (soon 4 more), located at the 2nd level of the UNIL / EPFL building named CUBOTRON / BSP

Displayed: about 160 objects (about 50 more in a near future)

CHOICE OF 7 REMARKABLES OBJECTS
(“Milestones”)
1. Regnier’s Dynamometer

- First light, transportable spring balance designed for scientific purpose: quantify animal or human muscular strength.

- Invented, named and published in 1898 by the Cn Edme Regnier (1751–1825).

- Main features:
  - one-piece closed loop spring;
  - pointer keeping the maximum value.

- Range (static force):
  - traction (animal): 0 to 1100 kg-force;
  - pressure (hands): 0 to 180 kg-force.

- For technical use, quickly superseded by better instruments (Poncelet, …) and others measuring work.

- Similar dynamometers still made during the XXth c., used by physical culture enthusiasts (bodybuilders)!

- Marking: “Dynamomètre de Regnier à Paris”
  Datation: 1st quarter XIXth c.

- Inv. 603.162

Cat. 2.4
2. Jakob Amsler’s Polar Planimeter

- First type of planimeter easy to make and to use. Measures the area inside a closed curve on a plane.

- Invented in 1854 by Jakob Amsler (1823–1912), then Gymnasium teacher at Schaffhausen.

- Tremendous success! Hundred of thousands produced by Amsler, who founded his own workshop in 1854, and by many others.

- Copied, improved, still in production today (with digital readout).

- Polar planimeter Amsler Type 3, made around 1867. 55 francs in 1878.

- Inv. 603.816  
  Cat. 1.2
3. Hipp’s Chronoscope

- First electro–mechanical chronometer able to measure time intervals (up to 30 s) with a resolution of 1 ms.
- Invented in 1840 in England by Charles Wheatstone (1802–1875), but not working satisfactorily.
- Matthäus Hipp (1813–1893), still working in Germany, begins to improve it in 1848. Moving to Switzerland in 1852, he sets up a workshop in Neuchâtel in 1860, where he perfects his « chronoscope » (besides making telegraphic equipment, etc.).
- Main features:
  - high-frequency vibrating rod clock;
  - electrical start/stop (electromagnets).
- At first sold without much success to physicists and ballisticians. From 1873, becomes a standard instrument in physiology and psychology laboratories, where it remains in use up to the 1930s. Copied by others, but not improved.
- « Chronoscope » Type 88, dated 1886–1887.
- Inv. 603.182
- Cat. 2.5
4. Piézo-Quartz of Pierre Curie

- Piezoelectricity has been studied at the end of the XIXth c. by the brothers Jacques and Pierre Curie. An electrical potential difference appears between the faces of certain crystals, suitably cut, when stressed. Conversely, a voltage deforms the crystal.

- The Piézo-Quartz (prototype built by Jacques Curie in 1888) has been much used by Pierre et Marie Curie as a generator of electric charges when measuring radioactivity by means of an ionisation chamber, compensating the discharge due to radiation by a charge generated by piezoelectricity. First use (quasi-static) of a phenomenon that was then no more than a laboratory curiosity. Tricky to use, no success except in France and in Poland…

- Applications to electro-mechanical transducers or oscillators begin quietly during WWI: “Sonar”, stable HF valve oscillators, laboratory quartz clocks. Starting in the 1960s, transistors make cheap quartz oscillators possible: today, there is almost no consumer electronic appliance without one or more quartzes, not to speak of the other numerous applications of piezoelectricity.

- Maker: SCPC, Paris, between 1890 and 1914

- Inv. 603.153

Cat. 16.04
5. Oscillograph by Siemens & Halske

- 2-channels oscillograph, with 2 bifilar mirror galvanometers of the kind developed in France in 1893 by André-Eugène Blondel (1863–1938), making possible the visualization, the projection and the photographic recording of the waveforms of both voltage and current in electric equipment built for AC power supply.

- First industrially produced oscillograph (at least on the continent), essential for the developing electrotechnical industry.

- Sold, with minor changes, up to the 1930s.

- Improved (i.e. faster response, more channels, long records) and miniaturized, this kind of instrument was still in production and used in the 1980’s.

- Built by Siemens & Halske, Berlin, between 1900 and 1920; price RM 1625 in 1912.

- Inv. 603.668
  Cat. 10.144
6. Mettler’s substitution Balance

- Range of high-precision laboratory balances, developed from 1945 by Erhard Mettler (1917–2000), near Zürich, based on a principle (“substitution”) at least 150 years old.

- Only one pan; annular weights (patented!) removed by turning knobs; asymmetrical beam; pneumatic damping; optical digital readout of the residual beam inclination.

- Extremely convenient to use!

- Enormous commercial success of Mettler balances in the 1950s, then expansion to other domains. Mettler-Toledo is now an important multinational company (2008: 10’000 employees, revenues USD 2 billions).


- Inv. 603.422 Cat. 2.4
7. PAIR OF MERCATOR GLOBES

Celestial globe (1551) and terrestrial globe (1541) by Gerardus Mercator

¿ Authentic ? ¿ Replicas (last quarter of XIXth c.) ?
Much more to see:
Come to Lausanne and visit the Museum!

Practical information (location, opening time, etc.) :

http://museephysique.epfl.ch
Contact : musee.physique@unil.ch

Author’s address :
Prof. hon. J.-F. Loude
EPFL
SB-IPEG-LPHE
BSP 530
CH-1015 Lausanne

I am grateful for the support, either financial, technical or administrative received from several institutions : UNIL, EPFL, SAV, AVCP, Pro Patria, as well as for the help provided by many friends, especially Fabio D’Ambrogio, Hans-Jörg Bühlmann, Sylvain Guillaume
If you are interested in old scientific instruments, consider joining the S.I.S.!

www.sis.org.uk