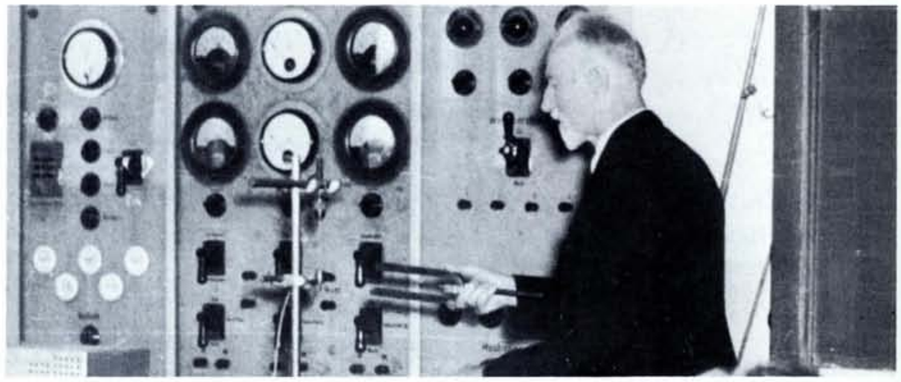
Barkhausen demonstrating his effect.



Heinrich Barkhausen

Physicist and Pioneer of Light Current Engineering

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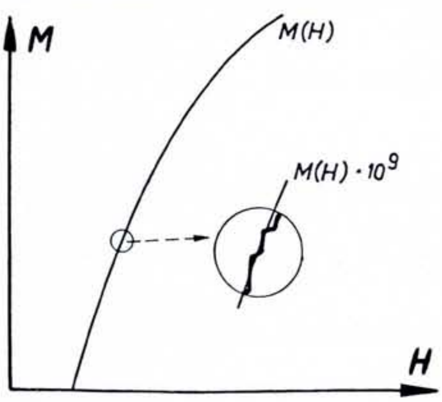
Heinrich Barkhausen was born on 2 December, 1881 in Bremen, and while still young, developed an interest in the natural sciences, and made up his mind to become a physicist. He began his higher education at the Technische Hochschule in Munich but became irked by the rigidity of the courses and the emphasis on mechanical exercises and changed to the university system. In 1902 he was a student at Berlin where he studied heat and mathematical physics under Max Planck, in 1903 at Munich and from 1903 to 1906 at Göttingen where he found the attention to applied science that suited him. He continued with his doctorate thesis at Göttingen in the Institute for Applied Electricity of H. Th. Simon working on the generation of oscillations and, in particular, on high frequency electrical oscillations.

From 1907 until 1911 he worked as scientific adviser in the electrical industry on problems of the manual and dial-in telephone exchange, notably the operating time of relays and control units. In 1910, he qualified as a lecturer *(Habilitation)* at the Technical College, Charlottenburg (the present Technical University in Western Berlin) and in 1911 he was appointed professor in the Technical College of Dresden (now the Technical University of Dresden) where he founded the Institute of Light Current Engineering. This was the first institute of its kind in a German university, possibly in a university anywhere, and no text-books dealing with the subject had yet been written.

Magnetization curve showing Barkhausen effect highly magnified.



In 1917, Barkhausen was beginning systematic research on electronic valves and in September of that year, he gave the first review of their functions and parameters, which formed the basis for a four volume book that for tens of years was a major source of reference for physicists and electronic engineers. In the course of his research in 1917, he discovered (together with K. Kurz) that a very high frequency oscillation with a wavelength of about 50 cm could be produced when the anode of a valve was negatively and the grid positively biassed (the so-called Barkhausen-Kurz oscillation). I believe this to have been the first electron transit-time oscillator in the world.

Another important discovery in the same year (made during high sensitivity measurements in the sea) was what is now called the Barkhausen effect. Barkhausen used an induction loop coupled to an amplifier (gain of 10^4) and a telephone for the detection of iron objects in water. Checking this arrangement with an iron-cored coil, he heard unexpected noises that he was able to interpret as resulting from the magnetization of the iron altering not continuously, but in discrete steps. Both discoveries it can be noted came out of experiments originally concerned with something quite different.

Barkhausen also worked on acoustics. In 1927, he designed a sound level meter and created the unit the phon. In the more than 50 years that have since elapsed, sound measurement has made great advances but three of his principles stand up today:

1. Sound intensity should be measured on a logarithmic scale;
2. Perception of loudness is strongly influenced by physiological factors;
3. Subjective influences and differences between individuals have to be taken into account in assessing effects.

Barkhausen and his pupils in Dresden were engaged in other important research on electro-acoustics and on sound attenuation, including reducing the noise from automobile exhausts.

Barkhausen worked until his death in 1956 in Dresden, teaching electronic engineering to large numbers of German and foreign students. Because of the many Japanese students who passed through his hands in the thirties, he has even been called the father of Japanese electronics.

In his thesis [2]) of 1907, Barkhausen examined very thoroughly the features of oscillation generation, showing a remarkable insight into the problems and developing general principles that were applicable to all types of oscillation — electrical, mechanical, acoustical etc. He reflected on the generation of periodic motion by a non-periodic force such as the waves in the sea driven by the wind or the vibration of a violin string stroked by a bow — the same questions that now are studied in the physics of self-organization and synergetics. Barkhausen recognized the crucial importance of non-linearities, controllable impedances and feedback, and he discovered that eigenvibrations are not a necessary condition of periodic motion. He recognized also the possibility of modelling mechanical and other processes by electrical circuits, a method that was used by his pupils in acoustics and since has been widely applied in all fields of engineering.

Possibly the most important contribution of Barkhausen to applied science was his realisation that a new discipline was coming into being. In his inaugural lecture at the Technical College, Dresden in 1911, he clearly defined the essential role of light current engineering as being concerned with signal transmission, wherein switchting and routing would be of great significance. In this he was anticipating information theory, digital electronics and systems engineering. Similarly, his books on electronic valves go beyond the treatment of a single electronic device, and give a broad introduction to analogue techniques. Indeed, his analyses of the performance of electronic valves have much that is relevant today to semiconductor devices and microelectronics. A bibliography of his publications may be found in Reference 1.

Barkhausen was a great believer in the need for a very close connexion to be made between fundamental and applied research. He combined the "wache Neugier, den Schleier der Natur zu lüften" (awake curiosity to lift off the veil of Nature) with the objective of giving a solid base to application, and an education to engineers so that they could go on and develop practical devices [1]).

Barkhausen was an outstanding university teacher who tried always to achieve the utmost simplicity and clarity, however difficult the topic. He also had the type of personality that could form the mind and character of his students while still encouraging them to express their own independence and creativity. He was great humanist and a warm-hearted person, interested in the personal problems of his students and ready to help them when they were in need.

There is much that is of interest in the life and work of Barkhausen, in the man himself, his physics and also in how he saw the place of physics in Society and the responsibility of physicists for progress in technology.

For all these reasons, the Academy of Science of the DDR (of which Barkhausen was a member) and the Technical University of Dresden are celebrating the 100th anniversary of his birth with a ceremony and scientific conference this month.

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2. Heinrich Barkhausen, "Das Problem der Schwingungserzeugung mit besonderer Berücksichtigung schneller elektrischer Schwingungen". *Thesis,* Göttingen, 1907.

3. Heinrich Barkhausen, "Die Probleme der Schwachstromtechnik" *Dinglers Polytechnisches Journal,* **92** (1911) 33/34 (also inclued in Ref. 1).

Computational Physics Group

The activities of the **Computational Physics Group** of the European Physical Society have, as objective, the sharing of experience and the dissemination of results of research into the application of computers to physics. Within this framework can be considered problems related to the computerization of experiments, data acquisition, interpretation of experimental data, data processing, theoretical calculations, as well as assistance in the design and utilization of physical instruments and facilities.

The main effort of the CPG is devoted to the organization of Conferences which may be general in character or concentrated on more specific aspects of computer applications in physics. In 1980, we had the Conference on Computing in High Energy and Nuclear Physics, held 9-12 September in Bologna, and recently, the Europhysics Conference on Vector and Parallel Processors, held 25-28 August in Chester. This was a general conference and covered the capabilities and potentials of modern, mostly large computers, and their impact on the development of physical research and applications.

Next year, 21-24 September 1982 in Warsaw, the Europhysics Conference organized by CPG in cooperation with the Institute of Nuclear Research, Swierk-Otwock, Poland, and the Polish Physical Society will be devoted to more specialized topics. Entitled "Computing in Accelerator Design and Operations" it will cover the use of computers in design and digital control, and the application of accelerators in research, medicine and industry. Future CPG Conferences are to be devoted to Computing in Plasma Research, Software for Engineering Tools, etc.

Another line of CPG activities is the organization of Summer Schools in Computing in Physics. They are organized in cooperation with the Czechoslovak Union of Mathematicians and Physicists in beautiful, old castles so richly distributed throughout that country. The last in Stara Lesna, 18-29 May was devoted to the use of microprocessors in physics and was accompanied by a workshop on symbolic languages.

It is planned that the next Summer Schools held in odd years, possibly organized also by other national physical societies, will be devoted to the application of data base concepts in physics as well to other software engineering methods and tools, which could be applied in physics.

A very interesting initiative of the CPG is the encouragement it is giving to the editing of handbooks of formulae and computing methods used in various branches of physics. A number of possibilities for the publication of these handbooks, which would make them available at low cost to EPS members, are at present being studied. The first two handbooks will be devoted to High Energy Physics, and Atomic and Molecular Physics. People interested in taking part in such activities should contact the Computational Physics Group Board. Their efforts will be assisted and sponsored by the CPG.

Next year, on 20 September in Warsaw, a general meeting of the members of the Computational Physics Group will take place, where the programme of further activities will be discussed. Everyone working in the field of computational physics or interested in its development is urged to join the Computational Physics Group. Furthermore all members of the Group are asked to participate actively in the general meeting so as to influence the formulation of objectives.

R. Zelazny

Plasma Physics Division

On 14 September 1981, the Board of the **Plasma Physics Division** held its annual meeting in Moscow during the 10th European Conference on Controlled Fusion and Plasma Physics. The first regular General Assembly of the Division took place at the site of the Conference on 17 September. It is time therefore to report again on the affairs of the Division as was first done a year ago (*Europhysics News,* **11** (1980) 7/8).

Although this is not the proper place to give a major scientific appreciation, it should be said that the Conference showed that there is steady progress in all fields of fusion-related plasma physics. Contributions came from colleagues from all over the world and, in particular, the Conference allowed us to gain a detailed insight into the work going on in the Soviet Union. In tokamaks, rapid progress has been achieved in divertor experiments and studies of the plasma edge, confirming the effectiveness of divertors in reducing the concentration of metal ions in the discharge. An improvement in plasma confinement and more detailed analyses of its parametric dependence were also reported and electron cyclotron heating of plasma has been demonstrated on a larger scale. Both theoretical analyses and experimental work have improved our understanding of stellarators, the reversed-field pinch and the bumpy torus and the dynamics and the structure of the plasma focus have been elucidated in more detail. Experiments in the tandem mirror configuration were reported in which the ideal MHD pressure limit was exceeded. Plasma compression by intense laser beams is studied with new, more powerful devices. Also new ideas on the muon fusion of DT were reported which suggest that this scheme might be more than just a curiosity. A highlight of the Conference was P.L. Kapitza's report on his work in thermonuclear fusion research. It is regrettable that some very relevant results obtained recently in western European laboratories were not presented at the Conference.

Turning now to matters discussed at the meeting of the Board and in the General Assembly: First, to prepare the 11th European Conference on Controlled Fusion and Plasma Physics, to be held 5-9 September,