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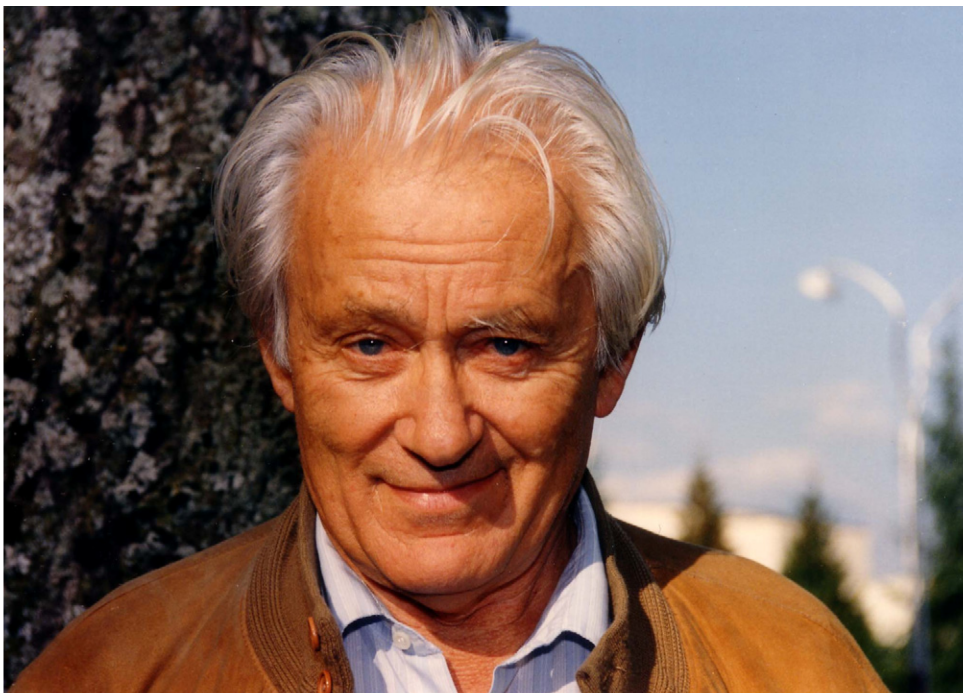
Georges Charpak



March 8, 1924 (Dąbrowica, Poland) –September 29, 2010 (Paris, France)

1992 Nobel Prize in Physics

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A tribute to Georges Charpak (1924–2010); Nobel Prize in Physics, 1992

Georges Charpak and his Contribution to Cherenkov Photon Detectors

In September 2010 our scientific community lost Georges Charpak, who had made remarkable contributions in the development of position-sensitive gaseous detectors and who was certainly for decades an outstanding leader in this field. His main invention was the Multiwire Proportional Chamber (MWPC) [1], for which he was awarded the 1992 Nobel Prize in Physics. This device resulted in a revolution in the detection of charged particles and photons leading to the development of many other position sensitive gaseous detectors. One of these was a MWPC-based Cherenkov Ring Imaging detector proposed by Jacques Seguinot and Tom Ypsilantis [2], which opened a new era in particle identification techniques.

Georges was always very open to new ideas and collaborations so it was thus natural that he-impressed by the idea of Seguinot and Ypsilantis – became engaged in the development of the RICH technique. Shortly after his involvement, Cherenkov rings were recorded in a real experiment using a multistep avalanche chamber suggested by one of his team members (Fabio Sauli) [3]. The same work also led to the design, for the first time, of proximity-focusing devices widely used nowadays in experiments. The multistep avalanche chamber was the only position–sensitive gaseous detector at the time capable of detecting single photoelectrons, and early gaseous RICH detectors were based on this device (see for example [4–8]).

Georges had a talent to identify bright young scientists and attract them to his group. The exchange of ideas between him and his collaborators was the main driving mechanism of his creativity. Nowadays, most of his formal collaborators are leaders of their own detector development groups. We provide below a few examples related to the development of RICH detectors.

In 1982, Georges invited David Anderson to join his group. A few years earlier, Anderson had identified a liquid-TMAE (Tetrakis-(diMethylAmino)-Ethylene)-whose vapour has an extremely low ionization potential (5.28 eV)-which allowed him to detect Xenon scintillation photons with a MWPC. Despite some technological difficulties, this vapour offered new possibilities for the RICH technique, leading to the almost immediate development of TMAE-based photosensitive gaseous detectors for DELPHI, OMEGA, SLD-CRID and other large and small RICH detectors.

TMAE has several interesting features: when used to dope the filling gas in MWPCs or parallel-plate chambers its vapour strongly emits visible light [9,10], making easier the optical readout of RICH detectors [11]. TMAE-based optical readout was successfully implemented in the NA35 experiment [12].

Also it was noted that TMAE can form a thin layer on metal surfaces, enhancing their quantum efficiency in the UV and visible regions [13–15].

Georges, excited by the fast developments in RICH techniques and by the unique properties of TMAE, launched a program in his group for the search and systematic study of various photosensitive substances in gaseous, liquid and solid states [15–19]. Most of these studies were made with the direct participation of one of us (Vladimir Peskov) and in close collaboration with other groups. For example, the first parallel-plate avalanche chamber with a Caesium Iodide (CsI) photocathode was tested in Charpak's group. The high achieved quantum efficiency, reported soon after at a Fermilab symposium on particle identification at hadron colliders [20], triggered great interest in this photosensitive material. Further systematic studies of CsI photocathodes were performed in collaboration with Seguinot and Ypsilantis' group [21], while Breskin's group very rapidly built a small MWPC with a CsI photocathode for the detection of light from gas scintillation chambers [22]. These three works initiated a new direction in the development of photosensitive gaseous detectors.

Building on George's pioneering work on this subject [20,23,24] a real breakthrough in developing CsI photocathode-based RICH detectors was made by the RD26 collaboration [25]. Nowadays several large scale detectors are equipped with "CsI RICHs": including ALICE, HADES, PHENIX and COMPASS.

Georges was always full of ideas and dreams. One of them was to develop gaseous detectors sensitive to visible light. Some preliminary studies and tests were made in his group [26–28] and later continued by Peskov and his collaborators in Russia, the USA [29,30] and in Israel (see for example [31] and references therein). After two decades of work, the first gaseous detectors having a sensitivity to visible light comparable to vacuum photomultipliers finally appeared [32]. Owing to their complexity, these developments have not found yet an application in a RICH detector. However, the work is being continued by Japanese groups in collaboration with Hamamatsu Photonics. Recent progress in this direction was presented at this conference [33].

In the last years of his life, Georges led a group at the École Nationale Supériure des Mines in St. Etienne, where-amongst other projects-he worked on novel ideas in position-sensitive micropattern detectors (MICROMEGAS), in collaboration with Ioannis Giomataris and others [34], and on photosensitive resistive thick GEM detectors for forest fire detection [35].

The last telephone communication he had with one of us (Peskov) was shortly after this RICH Conference. He was very happy to hear that the ALICE and COMPASS RICH groups had made the first successful tests of RICH prototypes based on thick GEMs and resistive GEMs coated with CsI layers [36,37].

When Georges learned about the ALICE plans to build a large area GEM-based RICH, he was as usual full of ideas and optimism, and said: "It is amusing that a GEM can operate in pure noble gases; I have an idea how to exploit this to make them sensitive to infrared light…I'll ask the St. Etienne people to make some tests…"

Georges will always remain in our memory as a person who made a revolution in detector development and created a community of followers.

Under his influence several detector development groups were formed throughout the World. The seeds he sowed are now delivering a rich harvest, with his former collaborators developing a new generation of detectors-the so-called micropattern gaseous detectors.

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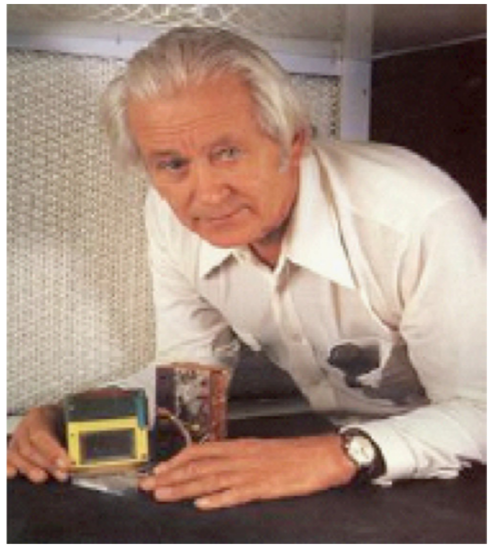
Vladimir Peskov, Fabio Sauli



Georges Charpak with a miniature drift chamber and a Multi-Wire Proportional Chamber