



## PORTRAITS OF SCIENCE

# "The Most Versatile Physicist of His Generation"

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"The most versatile and the best loved physicist of his generation": so said the British geophysicist Sir Edward Crisp Bullard in remembrance of P. M. S. Blackett (1897–1974) (1).

Bullard had known Blackett at the Cavendish Laboratory, where Blackett had supervised Bullard's experiments on electron scattering in hydrogen gas, before Bullard left particle physics for geophysics in 1931. Bullard and Blackett worked together in the 1940s in operational research at the British Admiralty, and Bullard afterward observed Blackett shift his laboratory research from particle physics and cloud chambers to the Earth's magnetic field, paleomagnetism, and magnetometers. Widely admired for his craft as an experimental physicist, Blackett was noted, too, for his broadly ranging theoretical interests in quantum electrodynamics, gravitation, and continental drift. A war veteran, Blackett had served in the Royal Navy during the first world war, and he was a civilian founder of operational research during the second world war. Blackett's range of expertise was truly unusual.

However, if Blackett was versatile, he also was controversial. This is the same Blackett who was said by the *Times* [of London] in 1974 to have been a "Radical Nobel-Prize Winning Physicist" who had been "committed too far to the [political] left for [even] a Labour Government to employ with ease" (2). Although many regarded Blackett as a hero for his achievements as a British physicist and his wartime role in operational research, others villified him for his postwar criticism of British wartime and Cold War military strategy. On facing pages of his local newspaper, the *Manchester Guardian*, appeared two articles about Blackett on 5 November 1948. One news item reported that Blackett had won the Nobel Prize in Physics. On the opposite page stood a review by the American sociologist Edward Shils of Blackett's book, *The Military and Political Consequences of Atomic Energy*. Shils baldly characterized Blackett's opposition to development of atomic weapons

as a Stalinist apology in which Blackett's analytical powers had fallen sway to political prejudices (3).

At root in the controversy over Blackett was not simply his political or military point of view, but his very right to express a strong opinion outside the field of physics. To Blackett, the objection that "science and politics do not mix" made no sense, especially with regard to military questions: "Why I should stick to Physics ... I cannot quite conceive. Anyway I have spent eleven years of my life in warfare. That gives me a title to talk about it" (2, 3). In feeling that he had an obligation to speak out, Blackett shared the perspective of British scientists in the leftist and sometimes marxist "social relations of science" movement of the 1930s and, for that matter, of French scientists engaged in 1930s Popular-Front politics. The French physicist Paul Langevin remarked of his own political activism, "The scientific work that I do can be done by others ... but unless the political work is done there will be no science at all" (4).

Blackett had a commanding presence in British scientific life. It was a physical and social presence, as well as an intellectual and political one. Tall and slim, always described as "handsome," admired for dressing well, Blackett entered Ernest Rutherford's Cavendish Laboratory in 1921 as one of the few physicists of his generation to have served and survived in combat during the first world war before beginning studies at the University of Cambridge (5). He had seen action in the Falklands in 1914 and at Jutland in 1916, serving as First Lieutenant controlling gunnery fire on the *H.M.S. Sturgeon* off Terschelling in 1918. In his naval education at Osborne and Dartmouth naval colleges during 1910–1914, Blackett had enjoyed what was probably the most intensive physical science and engineering

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A gifted, inventive physicist, Blackett was outspoken in his postwar criticism of British military strategy during the second world war and the Cold War.

secondary education available in England. While on wartime duty, Blackett obtained his first (jointly authored) patent, which described an instrument for measuring the rate of change of bearing in order to compute the firing of guns. By the time he walked into the Cavendish, he was considerably accomplished in tools, inventions, and instruments, but also in self-discipline, self-reliance, and experience of leadership (6). Then, as later, he was a man of strong opinions and apparent confidence.

Assigned by Rutherford in 1921 to modify an automatic cloud chamber, Blackett worked diligently to perfect the instrument in the face of Rutherford's impatience for results. In the summer of 1924 Blackett obtained eight tracks (from 23,000 photographs), confirming a nuclear transformation. His photographs showed the paths of an incident alpha particle that was captured by a nitrogen nucleus; an ejected proton; and the recoiling oxygen nucleus. These photographs have been widely reprinted ever since (7).

Blackett spent the 1924–25 academic year with James Franck in Göttingen and returned to Cambridge with new expertise from theoretical discussions with Paul Dirac and members of the informal physics club that met in

the rooms of Peter Kapitza. Blackett's next set of path-breaking experiments came in the early 1930s when he collaborated with Giuseppe Occhialini to devise a cloud chamber controlled by a Geiger-Müller counter, in which expansion of the cloud chamber was triggered by passage of charged particles through the chamber.

In late 1932, Carl D. Anderson at Caltech published an observation of a positively charged particle, with mass smaller than a proton, in cosmic radiation. He initially characterized its production as a rare event. By February 1933, Blackett and Occhialini had completed a paper

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## P. M. S. Blackett (1897–1974)

summarizing their analysis of some 500 tracks of cosmic-ray particles, of which 14 tracks were evidence of an anti-electron or positive electron, which they explicitly linked to Dirac's relativistic electron theory. Some physicists thought it unfortunate that Blackett and Occhialini appeared to have delayed publication, in order to get firmer data on the positive electron within the framework of Dirac's theory, so that it was Anderson who received the Nobel Prize in Physics for the "discovery of the positron" in 1936.

In 1933, Blackett moved to Birkbeck College in London and, in 1937, to Manchester, returning to London in 1954 to Imperial College. His research groups gathered evidence for the cosmic-ray cascade or shower effect, which he and Occhialini had first noted in their February 1933 paper. Lively debate occurred in the mid-1930s over the identity of a particle that Anderson and Seth Neddermeyer interpreted as a "mesotron" or heavy electron and that Robert Serber and Robert Oppenheimer suggested was the theoretical particle predicted by Hideki Yukawa in 1935. Cecil Powell and colleagues at Bristol found Yukawa's particle (the pi-meson) in cosmic radiation in 1947, demonstrating that the particle decayed into the mesotron ( $\mu$ -meson) and a neutrino. In the same year, at Blackett's Manchester laboratory, George Rochester and Clifford Butler announced discovery of another new particle, evidenced by a V-shaped track, which they interpreted, with Blackett's advice, as the result of decay of a heavy neutral ("strange") particle (8).

At this time Blackett moved away from cosmic-radiation studies, when he became intrigued by an old hypothesis that the magnetic fields of the Sun, stars, and Earth are a fundamental property of their rotating mass. In 1952, Blackett announced that he had failed to confirm this theory following a series of experiments using a magnetometer, which he designed, to detect minuscule magnetic effects in a rotating cylinder. Blackett noted the suitability of his magnetometer for a new field of investigation and turned his research group's efforts to measurement of remanent magnetism (paleomagnetism) in sedimentary rocks, leading to a new kind of evidence for Alfred Wegener's hypothesis (1912) of continental drift. Stanley Keith

**"Blackett noted the suitability of his magnetometer for a new field of investigation... paleomagnetism...."**

Runcorn, Edward A. Irving, and John A. Clegg were among those who worked at some point with Blackett's magnetometer and its successor instruments, contributing to a new geophysics based on the theory of the continents' past motions in relation to the Earth's magnetic pole (8).

Magnetic effects and magnetic mines had been a practical concern of Blackett's during the war. He had been recruited by Henry Tizard in early 1935 to join an Air Ministry committee charged with investigating the use of radio waves in air defense. At the time, the political Left, with which

Blackett was sympathetic, was largely pacifist, but pacifism was a sympathy that Blackett did not share. In 1940, Blackett was scientific adviser to the Army's anti-aircraft command, organizing a group of scientists to study the operational use of radar, guns, and mechanical calculators for anti-aircraft fire. In the Royal Air Force's Coastal Command, he headed

a group that recalculated depth settings for antisubmarine explosives. At the Admiralty from 1942 to 1945, his operational research group brought about significant improvement in the use of airborne radar for finding German submarines that were sinking merchant ships in the Atlantic (7).

At war's end, Blackett made public his wartime arguments against saturation bombing of German cities. As demonstrated by Shils's review, Blackett's 1948 book, republished in 1949 in the United States under the title, *Fear, War and the Bomb*, excited anger and invective because of its sympathy with Soviet objections to American plans for control of atomic energy, its criticism of the bombing strategy during the war (escalated at Hiroshima and Nagasaki), and its debunking of claims that bombs and the air force alone can win a war (3).

During the next decade, Blackett excoordinated applications of game theory to nuclear war by scholars at the RAND Corporation, the Hudson Institute, and Princeton University. By the time that Blackett's collection of essays, *Studies of War: Nuclear and Conventional*, was published in 1962, many of his arguments no longer seemed radical, especially his reiterated warnings that nuclear weapons would not make conventional war outmoded and that cutbacks in nuclear and conventional weapons should be negotiated in tandem (9).

Blackett's postwar publications and

speeches gained scrutiny from American embassies, the American FBI, and, likely, British security's MI5. He came under suspicion, too, for his Third-World sympathies. In particular, he was criticized by many members of his scientific audience for using the occasion of his Presidential Address at the Dublin Meeting of the British Association for the Advancement of Science in 1957 to advocate massive foreign aid to underdeveloped countries, particularly from the UK to former colonies. Scientists and engineers had a particular responsibility in this matter, Blackett argued, because "it is their genius and their skill which alone can bring the material basis of happiness within reach of all.... The uneven division of power and wealth, the wide differences of health and comfort among the nations of mankind, are the sources of discord in the modern world, its major challenge and, unrelieved, its moral doom" (7).

In a recent political history of the Nobel Prizes, Robert Marc Friedman suggests that Blackett received the physics award in 1948 partly because of Swedish Social Democrats' sympathy with scientific planning and with international controls on nuclear weapons, as well as admiration for Blackett's achievements in operational research (10). Of course, it was Swedish physicists and members of the Swedish Academy of Sciences who decided the award, not the Social Democratic leadership. In the official presentation speech for Blackett in Stockholm, the experimental physicist Gustaf Ising noted that the physics prize may be awarded for "discovery or invention" and that the award to Blackett was motivated on both grounds: Blackett's leadership in the development of the Wilson cloud chamber and the discoveries that he had made with the method. If Blackett's politics won him some sympathy in Sweden, it was his versatility and distinction in the practice of physics that gained him the Prize, as well as the admiration of physicists and geophysicists such as Bullard.

#### References

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