Richard Dalitz 1925–2006

The Dalitz plot, Dalitz pairs and Castillejo–Dalitz–Dyson poles have made the name of Dick Dalitz, who died on 13 January, a byword in high-energy physics for half a century. With his death, international physics has lost a major figure and Britain has lost one of its greatest unsung scientists.

Born in Dimboola, Australia, Dalitz gained degrees in mathematics and physics at Melbourne University, moving to the UK in 1946 to study for a PhD at Cambridge. He then worked at Bristol University for a year, before joining Rudolf Peierls in Birmingham in 1949. In 1953 he was given leave to visit the US for two years, working primarily at Cornell. He then joined the faculty at Chicago and its Enrico Fermi Institute for Nuclear Studies in 1956. He returned to the UK to work again with Peierls in 1963, this time as Royal Society Research Professor at Oxford University, a post he held until his retirement in 1990.

Dalitz’s thesis was in nuclear physics and dealt with 0° to 0° transitions in oxygen; forbidden as transitions involving real photons, due to angular momentum conservation, they occur by means of e+ e− emission. This experience led him to his first seminal contribution with his work at Birmingham in 1951 on Dalitz pairs, a phenomenon that has been used for example to measure the parity of the π0.

Among the particles found in cosmic rays at this time were two known as the τ and the θ, which had the same mass and lifetime; however, the τ decayed into three pions, the θ into two. In 1953 Dalitz began to look at the decays of the τ into three pions and in doing so introduced into physics what he modestly called a “phasespace plot”, but which everyone now knows as the Dalitz plot. This revealed that the τ particle had even spin and odd parity, e.g. J=0", while the decay θ → 2π and conservation of parity implied J=0", 1", 2"... for the θ. Thus was born the τ-θ puzzle: how could two mesons have the same masses and lifetimes and yet have different quantum numbers?

The puzzle persisted for two years, during which Dalitz mused to colleagues that perhaps the law of parity was not true, even though all the evidence said otherwise. However it was collected into families based on a more fundamental trio of “quarks”. What was less clear was whether these quarks were just a mathematical convenience or were themselves real particles.

For Dalitz, quarks were real. In his model, the laws that determine the rotational states that electrons can take up within atoms were applied to the quarks within the proton and the resonances. In a remarkable talk in Tokyo in 1965 he proposed that the quarks could be raised into different energy states, following the established rules of non-relativistic quantum mechanics. This implied the existence of many baryon resonance states with spins and parities in agreement with the emerging data.

Over the following decades many other examples of meson and baryon resonances were discovered, notably by application of Dalitz plots, and the quark model became established as the explanation of the menagerie of particles.

Dalitz was also interested in hypernuclei – atomic nuclei in which a nucleon had been replaced by a strange baryon. He collaborated with Avraham Gal in this area for many years. He was also intimately involved with the identification of the top quark. With Gary Goldstein he worked out a geometrical method by which experimental data could be used to deduce the top mass, which they applied to an early possible event from Fermilab. The conclusion was that if this event indeed signalled top production, the top quark mass must exceed 130 GeV.

Dalitz brought many scholars to Oxford and trained generations of students, including Chris Llewellyn Smith, a future director-general of CERN. Following retirement he remained an inspirational figure to students new and old, continuing to work on theoretical physics with undiminished enthusiasm.

Among activities outside of physics, Dalitz researched the origins of the Dalitz name, and wrote on the history of the Wendish people, who survive to this day in a few villages between Cottbus and Berlin. His curiosity led him to cast new light on aspects of Wendish history, including a biography of the poet Mato Kosky.

Frank Close, Oxford.