

Obituary

Fred Hoyle (1915–2001)

Fred Hoyle, who died on 20 August at the age of 86, was the most imaginative of men, a kind of Leonardo. He made monumental contributions to astrophysics and cosmology, and was a brilliant popularizer (and science-fiction writer and occasional playwright). He also put his name to much rubbish and was embroiled in controversy for most of his life.

Hoyle was born and brought up in Yorkshire and remained a true son of that county — directly spoken, combative, careful with money and self-reliant. He learned to read, he said, from subtitles on the silent films he saw at the cinema, while playing truant from school. How natural, then, that he should become a scholarship boy at the University of Cambridge, in 1933. And that over the following three years he should work his way as a mathematician to the top of his class.

The ensuing period as a research student was the best of Hoyle's professional life. With Rudolf Peierls as his supervisor, he had an admission ticket to the weekly theoretical seminar at the Cavendish Laboratory attended by the luminaries of the day. Hoyle then persuaded Paul Dirac to take him on as a student (by promising Dirac that supervision would not be required), and in due course produced an item of world-class thinking. With Ray Lyttleton he showed how to calculate the luminosity of a star from knowledge of its mass, so providing a theoretical basis for Arthur Eddington's empirically derived relationship between stellar mass and luminosity.

After work on radar during the Second World War, Hoyle's career had three main strands: the constitution of stars (made tractable by Hans Bethe's 1937 account of how stars can get their energy by the conversion of hydrogen via deuterium to helium); nucleosynthesis (the production in stars of elements heavier than helium); and 'steady-state' cosmology (the idea, to be contrasted with Big Bang theory, that the Universe is the same everywhere and its expansion can be accounted for by the continual creation of new matter).

The first theme led directly to Hoyle's founding in 1966 of the Institute of Theoretical Astronomy at Cambridge, with the self-mocking acronym IOTA. The institute's foundation came seven years after it had been proposed, and only after bruising rows with the university and the UK Science Research Council. It was subsequently renamed the Institute of Astronomy.



Cosmologist and controversialist

Nucleosynthesis had a happier outcome. Hoyle had won his spurs by predicting that carbon can be synthesized plentifully in stars (as it is) only if there is a metastable excited state of the carbon nucleus; W. A. Fowler, with his van de Graaff machines, showed that to be correct. Hoyle and Fowler then accounted for the elements up to iron, and Margaret and Geoffrey Burbidge, with Fowler's collaboration, sought to make sense of the abundances of the heavier elements. Finally, all four put their heads together and in 1957 published in *Reviews of Modern Physics* the classic paper now known affectionately as B²FH. Fowler won a Nobel prize for his work. Hoyle, shamefully, did not.

The business of the steady-state Universe has always been more contentious. The originators of the idea were Hermann Bondi and Thomas Gold; Hoyle was an interloper of a kind. Perhaps he relished the inevitable row. But he did not enjoy the personal animosity engendered between him and the late Martin Ryle, then one of the big-hitters in British astronomy. Hoyle believed that the ill-feeling went back to a disagreement at a conference in 1951, in which he had come out on top. Ten years later Ryle got his own back at a media event, which — so general opinion had it — spelled the end of the steady-state theory with Hoyle's seeming failure to respond to the evidence marshalled against it.

None of this had prevented Hoyle from being elected to Eddington's old chair in 1958 and, later, being chosen as chairman of the Science Research Council's main

astronomy committee. In that role, he was influential in putting the Anglo-Australian Telescope on a sound administrative footing, and in the mid-1960s accepted what proved to be a poisoned chalice — chairing a review of telescope provision in the Northern Hemisphere for British astronomers.

Initially, Hoyle was as cheerful as I ever knew him: he bubbled with conviction that much could be done at reasonable cost. But the cards were stacked against him, and the upshot of long-drawn-out manoeuvring was a stitch-up by his opponents. Following defeat at a crucial meeting in November 1971, Hoyle quit his chair at Cambridge.

Then what? Without a salary and five years short of pensionable age, Hoyle had to earn money, and quickly. So he spent two years lecturing in the United States before returning to Britain and diving into controversy from his position, assumed in 1975, as visiting professor at the University of Cardiff. This was a post sponsored by Chandra Wickramasinghe, with whom Hoyle published his most controversial views. The most egregious example was the allegation that the British Natural History Museum's specimen of *Archaeopteryx* is a forgery. Even his best friends were at a loss to know why he behaved in such a way in this and other instances.

But Hoyle was by no means off his head. In 1994, with Jayant V. Narlikar he published in *Reviews of Modern Physics* a meticulous account of how the current formalism of quantum field theory can be replaced by the formalism of advanced and retarded potentials that sprang from Maxwell's time. If ever quantum-field theorists want to return to properly relativistic action-at-a-distance, there is their recipe. And only last year came the book *A Different Approach to Cosmology*, by Hoyle, Geoffrey Burbidge and Narlikar, published by Cambridge University Press. This is a scholarly rather than a polemical work, in that it is a well-documented guide to extragalactic evidence against the Big Bang (a term, incidentally, intended to be derisive, that was coined by Hoyle himself in a broadcast lecture of 1952). My own conviction is that Hoyle's scepticism was well-founded. But it is too soon to tell how the Big Bang will be replaced by some other cosmology. That is heterodoxy. Soon after *A Different Approach to Cosmology* appeared, I asked one of Hoyle's former colleagues if he'd read it. "Wouldn't waste the time," was the reply. The hope must be that civility will break out among Hoyle's enemies now that he is dead.

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