

FRED HOYLE AND NAVAL RADAR 1941–5

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Abstract. The author spent the years 1941–5 as a member of Fred Hoyle’s Theoretical Group in radar research for the Admiralty. Fred was in his mid-twenties when we first met, and a few personal reminiscences are presented. A brief description follows of the composition of the theoretical group. The major aim of the paper is to outline three important contributions which Fred made to the use of radar at sea: (1) height estimation of aircraft at metre wavelengths; (2) anomalous propagation at centimeter wavelengths; (3) detection of aircraft in the presence of window jamming. Finally, an account is given of the determined manner in which Fred negotiated his release from the Admiralty in 1945 so that he could work full time on an idea of major importance to astrophysics which had recently occurred to him; this idea, which he referred to as ‘the abundance of the elements’, (later known as nucleosynthesis) is generally regarded as his most significant contribution to science.

Introduction

I first met Fred Hoyle in July 1941 when I joined the Admiralty Signal Establishment (ASE), the body responsible for radar research and development for the Navy. I was then 20 and had just graduated in mathematics from Cambridge; Fred was 26, a Junior Fellow of St. John’s College. The electrical engineers who ran ASE did not quite know what to do with theoreticians; their attitude was scornful, and they assumed that the area in which theoreticians could best contribute was probably aerials and propagation. The aerials division was located at Nutbourne in fields and primitive huts in the countryside northeast of Portsmouth; headquarters of ASE were at Eastney near Portsmouth.

Fred had joined a few months before me, and had been assigned to Hut No. 2 with lots of literature about radar to think about. I was less prestigious and they decided to teach me radar from the beginning, starting with the soldering iron. When I proved completely hopeless at this they assigned me to Fred in Hut No. 2.

Fred greeted me warmly and we chatted about our experiences at Cambridge. Although he had also taken the Mathematics Tripos, he had no real bent for mathematics; for him mathematics was an invaluable tool for scientific exploration. Since I had an interest in mathematics per se he would gladly assign any pure mathematical problems to me. He also said that although he appreciated the importance of devoting time and thought to the war effort, he did not consider that we needed to stop thinking about fundamental problems in physics.

He then told me how he had moved from quantum electrodynamics to astrophysics, and outlined the ideas that he and Lyttleton had put forward on accretion, and the difficulty they had experienced in getting them accepted by the establishment. Turning to my personal situation, he assumed that I must be looking around for a field in which to do basic research, and he strongly recommended astrophysics. 'The leading British authorities in the field' he said, 'are Eddington, Jeans and Milne. Of these three Jeans and Milne have done nothing of real significance. Eddington may have done one or two significant things, but he is still pretty mediocre; in a field in which the top researchers are so mediocre you should have no difficulty in making your mark quickly'. A week or two later he came in one morning excitedly waving the current issue of the 'Monthly Notices'. 'Eddington has just made an elementary error which you can easily identify. If you send off a quick note pointing it out you will have started your research career'. It was not appropriate for Fred himself to do this since he was a party to the dispute. Since Eddington had been one of my Part III examiners only a few weeks previously, I did not feel that I was the person to engage in public criticism of his work.

During the next few months I saw quite a lot of Fred since we were the sole occupants of the hut, and I should like to devote a few minutes to my personal impressions. His mental energy was amazing. He never seemed to switch off completely but instead switched from one topic of interest to another. Towards the end of the day he would relax by reading science fiction. When I chided him for wasting time on such low grade literature, he replied 'I have a purpose in mind. These people don't know any real science and they make money by writing this stuff. I, who know some science, should be able to do much better.' In fact he did later on pioneer some first class science fiction, which paid very well, and dwarfed his academic salary; it enabled him to resign his Cambridge Chair and move to the Lake District, a crucial step in his unconventional career.

On one occasion he expressed a desire to learn what pure mathematics was all about, and I managed to get hold of a book by Littlewood. He read steadily for a few days and was impressed. Then he came upon a point which he was sure Littlewood had got wrong. I was certainly not capable of deciding, but it taught me that Fred could not devote attention to any topic without evoking a personal reaction, generally critical.

Fred was anti-establishment. He was a junior Fellow of St. Johns, and he would regale me with stories of how an enfant terrible in the Senior Common Room succeeded in deflating the ego, and ridiculing the conventional stuffiness of the senior dons who ran the College. Fred described himself to me as a committed atheist, and he knew that I was an observant Jew; our basic beliefs could not have been further apart, and yet I cannot recall any occasion on which this led to a clash or to ill-feelings. In fact, Fred was very considerate of other people's feelings, and he confided to me that, despite his atheism, when he married a couple of years previously, he agreed to his bride's request, on sentimental grounds, for a church wedding; but he told the vicar of his real views, and the latter agreed to keep the ceremony short.

Fred was also scornful of government honours and awards. 'If ever they offer me a knighthood, I'll turn it down; by accepting it you put yourself in the same social class as treacle merchants'. He quoted with relish the story of George Bernard Shaw who, when offered a knighthood, replied 'I wouldn't accept anything less than a Barony, and I couldn't afford that'. They then offered him the prestigious 'Order of Merit' (OM). 'Ah' he replied, 'I awarded that to myself some years ago'. In fact many years later Fred did accept a knighthood without demur; perhaps he mellowed as he did later in regard to atheism, but I suspect that consideration of his wife's feelings played a part in his decision.