

THESIS ABSTRACT

SPECTRAL ENERGY DISTRIBUTION MODELLING OF X-RAY-SELECTED AGNS
AND THEIR HOST GALAXIES*By Adam Marshall*

The nature of the relation between active galactic nuclei (AGN), and their host galaxies has been observed in detail throughout the Universe. Such work has found an intrinsic link between central supermassive-black-hole (SMBH) masses, and host-galaxy properties such as the velocity dispersion of stars, and bulge mass. However, the difference in scale between SMBH and their host galaxies has led to debate on how this relation might form and develop over time. In order to aid in understanding the relation between AGN and their host galaxies, the work throughout this thesis has therefore focussed on the development and implementation of a new spectral-energy-distribution (SED) fitting code, using an up-to-date AGN SED to infer accurately both AGN and host-galaxy properties. To this end, we explore the intricacies involved in producing useful property inferences using a Bayesian MCMC fitting method, whilst working to avoid common issues such as bimodality and lack of convergence. We then perform SED fitting using our methods to 711 luminous X-ray AGN at $0.7 < z < 4.5$ using 10 bands of optical and infrared photometric data for objects within *XMM-SERVS*. Using these fits, we study the relation between AGN X-ray luminosity and host-galaxy stellar mass, along with our ability to predict emission-line strength and morphology from photometry alone. In order to understand further the intricacies of SED fitting, we also provide a case study into the effect of AGN-SED choice on host-galaxy and AGN-property inferences by comparing our AGN SED to another commonly used template. In this work, we show that it is important to consider host-galaxy contamination when trying to produce a pure AGN template, and the effect that this contamination can have on AGN and host-galaxy-property inferences. We also find that the use of lower-resolution SEDs can lead to repercussions on property inferences such as host-galaxy stellar mass, which may provide incorrect assumptions on the relation between AGN and their host galaxies. — *University of Cambridge; accepted 2023 February.*

OBITUARY

Phillip John David Gething (1929–2023)

Phillip was born on 1929 August 22 and brought up in Luton, where he attended Luton Grammar School from 1939 to 1946. He won a Royal Scholarship to Imperial College and in 1946 October, at the age of 17, began a compressed two-year course for a maths degree in the company of many ex-servicemen and a few school leavers. A third year was compulsory for school leavers so, having become increasingly interested in astronomy, he chose the MSc course in optics and then returned to the maths department as a PhD student under Dr. Whitrow from 1949–51.

For his PhD research, Phillip looked at various problems concerning the origin of cosmic rays and comets, and the applications of kinematic relativity to cosmology, and had three papers published, the most substantial in the *Proceedings of the Royal Society*.

By good fortune, scientific posts at the Royal Observatory were being advertised as he completed his thesis. Phillip started work in the Meridian Department at Greenwich in August, as the first-ever Scientific Officer employed there under a new grading system for the whole of the scientific civil service. His duties involved a mixture of observing, arithmetic, and research investigations. In 1952 he joined the Royal Astronomical Society, and remained a Fellow for the rest of his life — over 71 years of membership! From 1954 to 1956 Phillip was on the editorial board of *The Observatory*. He also became a member of a commission of the International Astronomical Union concerned with comets.

Phillip married Helen Slater in 1953, and they started their married life in Highmore Road, Blackheath. Their elder son, David, was born in Greenwich.

Then the transfer to Herstmonceux Castle in 1954, living first in a rented bungalow in Pevensey Bay and then in a council house in Herstmonceux village, where younger son Martin was born. Phillip supervised the installation of a new instrument, the *Photographic Zenith Tube*, then organized the observing routines and methods of calculation to derive accurate time and latitude: he found this a most interesting project. He played bridge with the new Astronomer Royal, Dr. Woolley, attended lectures in Oxford with him and Tommy Gold, and found time to play chess in a tournament in Hastings.

After a time Phillip began to find the routine calculations and irregular observing duties were losing their appeal. He came under pressure from Woolley to spend a few years in South Africa, at the Royal Observatory at the Cape, but was not willing to do so. Eventually he asked for a change, and accepted a transfer to Government Communications HQ in Cheltenham in 1957. There Phillip and Helen were able to buy their first house and for the next 18 years he enjoyed his work in the Science and Engineering Division. In 1970 he received an 'Individual Merit' promotion that freed him from routine administrative duties in order to give more time for research.

Throughout his time in GCHQ Phillip worked on radio propagation, radio direction finding, and the design of improved antenna arrays. He also ran a number of contracts with industry and universities, sometimes acted as external examiner for candidates seeking higher degrees, and was able to publish several scientific papers in the open literature. He made many visits to the USA and organized a comparison trial of rival direction finders used by the US Air Force and the US Navy, and wrote the report on the results.

By 1975, when both sons had departed to university, Phillip felt that he had done all he could in his chosen fields and that he ought to get back into the main management stream. He transferred to the Admiralty Compass Observatory, Slough, where he looked at problems of integrated navigation for the Royal Navy: his background in astronomy and in radio position-fixing techniques proved useful.

Soon after, Phillip was appointed as head of the computer-techniques division at the parent Admiralty Research Establishment near Portsmouth, and the family moved to Waterlooville in 1977. His team was mainly concerned with the use of computers at sea for Command and Control systems, and they worked very closely with the Royal Navy — the Falklands Campaign in 1982 showing the importance of their work.

In 1983 Phillip transferred to the Ministry of Defence (MoD) headquarters in London as Assistant Director of Defence Procurement for cryptographic devices and strategic communications systems. He and Helen moved to Fleet, from where he could commute to London by train each day. He became project manager for a number of major contracts to develop and install new systems for the RAF, including the command centre at High Wycombe.

At the end of 1987 Phillip took early retirement from the Civil Service and joined Admiral Management Services in Camberley as a management consultant. He put together a successful bid for a multi-million-pound contract with GCHQ and was then appointed as the facility manager for a software evaluation facility, looking particularly at security issues on behalf of the MOD.

Phillip retired in 1989 but continued giving occasional lectures at the Royal Military College of Science, and was external supervisor for an Australian officer working on a Direction Finding project as part of his MSc course. He kept busy throughout his retirement: serving on the management committee of Fleet Citizens Advice Bureau for 13 years, and as lay member of the medical ethics committee for North and Mid Hampshire, with monthly meetings at the Royal Hampshire Hospital in Winchester.

Chess had been one of his main hobbies from school days onwards, and in various periods Phillip had represented Bedfordshire, Gloucestershire, and Hampshire in county matches. He also enjoyed creative writing, and belonged to writing circles in Slough, Waterlooville, and Fleet. He had a number of short stories and articles published, and one-act plays performed.

Phillip and Helen celebrated their golden wedding anniversary in 2003. However, Helen's health began to fail and she passed away the following year. Phillip died peacefully on 2023 July 12 and is survived by two sons, four grandchildren, and three great-grandchildren. — MARTIN GETTING.

Here and There

JUST MISSING A MILLION?

R136a is, of all the stars known to astronomy, the brightest and most massive. It shines ten times brighter than the Sun, and the only reason we don't notice it is that it's so very remote. — *A History of the Universe in 100 Stars* (Quercus Press), p. 290, 2022.