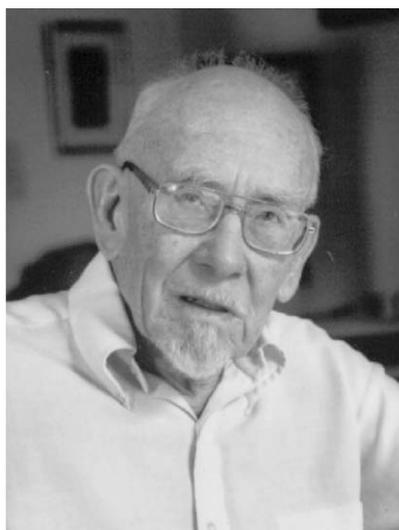


In Memoriam
Edward S. Kennedy
1912–2009



1948



1997

Ted Kennedy

Edward Stewart Kennedy, Ted for his friends and Kindī¹ for his closest colleagues, died peacefully in Doylestown PA on May 4, 2009. Kennedy was the most important scholar of Islamic mathematical astronomy during the second half of the 20th century. Standing in the tradition of such great predecessors as Carlo Alfonso Nallino (1872–1938) and Heinrich Suter (1848–1922), he applied the technical methods of analysis introduced for Babylonian astronomy by Otto Neugebauer (1899–1990) to Arabic and Persian astronomical works. An intimate knowledge of the primary sources and detailed analyses of the mathematical models and computations underlying them lay at the basis of his research. For a wide range of technical topics in Islamic astronomy, Kennedy was the first to describe them in detail and to provide an overview of their development across the centuries. He was the

¹ Kennedy is written K-n-d-y in unvowelled Arabic, as is the name of the famous 9th-century Muslim philosopher Abū Ya‘qūb ibn Ishāq al-Kindī.

major example for a large number of younger scholars, most notably David A. King, George A. Saliba, and Julio Samsó.

Edward S. Kennedy was born on January 3rd, 1912 in San Ángel near Mexico City.² After the return of his family to the United States he went to school at Easton PA, where he obtained a degree in electrical engineering from Lafayette College in 1932. Thanks to an agreement of Lafayette with Alborz College in Tehran, run by the American Presbyterian mission, Kennedy spent the next four years in Iran, where his lifelong love for the Persian language and culture germinated, and where he did his first work on the history of Islamic science. In 1939 he received a PhD in mathematics from Lehigh University in Bethlehem PA, and in the same year he became an assistant professor in mathematics at the University of Alabama in Tuscaloosa.

World War II allowed Kennedy to return to his beloved Iran as an Assistant Military Attaché at the US Embassy in Tehran. After having studied Arabic at Harvard University immediately after the war, he was appointed at the American University of Beirut (AUB) in 1946, where he would stay till his retirement in 1976. Although his main duty was to teach introductory mathematics and computer science, he had an arrangement that allowed him to work at Brown University every fourth year, where in particular his contacts with Otto Neugebauer and David Pingree inspired him to carry out extensive investigations in the history of Islamic mathematical astronomy. At AUB a course and a seminar on the history of mathematics in alternating years led to a large number of papers on Islamic astronomy by students, all of which bore witness to Kennedy's influence. After his retirement, Kennedy and his wife spent two years at Cairo and at the same time became affiliated with the newly founded Institute for the History of Arabic Science in Aleppo. The war in Lebanon prevented them from spending their retirement in their house in the forests overlooking Beirut. From 1984 to 1988 they were guests of the Institute for the History of Arabic-Islamic Science in Frankfurt am Main, then they moved back to the United States, where they lived in Princeton and, since 1999, in Doylestown PA. In 2001, Kennedy was made a member of the Order of al-Istiqlāl by Crown Prince Hassan of Jordan for his contribution to the study of Islamic culture.

Kennedy's publications on Islamic mathematical astronomy concentrated on a number of large themes. Central to various of these were Islamic astronomical handbooks with tables, called in Arabic and Persian *zīj*es. This important category of scientific literature derived from Ptolemy's *Handy Tables* and *Almagest*, and, in particular in the early Islamic period, was also influenced by Indian and Sasanian astronomical works. As early as 1956, Kennedy published "A Survey of Islamic Astronomical Tables" (*Transactions of the American Philosophical Society*, vol. 46, no. 2, pp. 123–177; reprinted in 1989), in which he presented brief information on the approximately 125 *zīj*es that he had then identified, gave technical details of 12 of the most important works, and provided an outline of the subject matter of *zīj*es and the developments in Islamic astronomy between 800 and 1500. In spite of additions published by David King and Julio Samsó in the journal *Suhayl*

² Because I entered the history of Islamic science only when Kennedy was already 74 years old, I had to rely on other sources for his early life and career. I am very grateful to David A. King for letting me use the biography in *From Deferent to Equant. A Volume of Studies in the History of Science in the Ancient and Medieval Near East in Honor of E.S. Kennedy*, Annals of the New York Academy of Science, vol. 500, 1987, pp. xiii–xvi, and to the Kennedy family for further information and photographs.

(vol. 2 (2001), pp. 9–105) and the work in progress by the present author on a more extensive new catalogue, the 1956 *Survey* is still the standard work on Islamic *zīj*es.

One particular *zīj* that became a red thread throughout Kennedy's career was the Persian *Khāqānī Zīj* by Ghiyāth al-Dīn Jamshīd al-Kāshī (d. 1429), which he wrote in 1413 before he became the director of the famous observatory of the Timurid sultan Ulugh Beg in Samarqand (presently in Uzbekistan). Al-Kāshī was a computational genius, whose incredibly accurate determinations of π and of the sine of 1° were made well known by Paul Luckey and Asger Aaboe in the early 1950s. But also his *zīj* is a treasure trove for ingenious mathematical applications to astronomy and in addition, unlike most other *zīj*es, includes definitions of technical terms and proofs of geometrical theorems. Kennedy realized the significance of the *Khāqānī Zīj* at a very early stage and prepared a preliminary English translation of the very difficult text in the 1950s. Unfortunately this translation has remained unpublished until now, but a fully annotated table of contents of the *zīj* appeared in the series *Islamic Mathematics and Astronomy*, vol. 84, of the Institute for the History of Arabic-Islamic Science in Frankfurt am Main in 1998. Detailed overviews of the technical contents of two chapters from the *Khāqānī Zīj* and analyses of various other topics from the work were published by Kennedy in a number of journal articles.

Already in the late 1940s, Kennedy had studied the Persian translation of an Arabic work by al-Kāshī of a very different nature, namely *A Fruitful Garden Stroll*. This treatise describes instruments for performing calculations of astronomical quantities, such as planetary longitudes and latitudes, conjunctions, and solar and lunar eclipses. Kennedy published descriptions of the use of these instruments in journal articles, and finally the whole treatise in book form in 1960. Herewith he introduced the extremely practical format that he used in a number of later publications of sources, namely a facsimile of the most important surviving manuscript, an English translation on facing pages, and a historical and technical commentary.

Besides al-Kāshī, the famous polymath Abū Rayḥān Muḥammad ibn Aḥmad al-Bīrūnī (973–1048), who spent his early life in Khwarazm, south of the Aral Sea, but later served the Ghaznavid sultans in the present-day Afghanistan, was one of the other main focuses of Kennedy's research. He translated two of the four treatises by al-Bīrūnī of which editions were made accessible by the Osmania Oriental Publication Bureau in Hyderabad in 1948, namely those on shadows (dealing, among other things, with sundials and tangents) and on the astrological concept of transits. Furthermore, he wrote a commentary on al-Bīrūnī's highly important treatise on mathematical geography, entitled *Tahdīd nihāyāt al-amākin* (*Determination of the Coordinates of Localities*). Finally, Kennedy authored the comprehensive article on al-Bīrūnī in the *Dictionary of Scientific Biography* and a critical table of contents of al-Bīrūnī's *zīj*, the *Mas'ūdī Canon*.

Although Kennedy's publications (co-authored with his students Victor Roberts and Fuad Abbud) on the 14th-century Damascene timekeeper Ibn al-Shāṭir are not as voluminous as those on al-Kāshī and al-Bīrūnī, they are even more significant from an historical point of view. Kennedy found that Ibn al-Shāṭir's planetary models were mathematically equivalent to those of Copernicus 150 years later, thus providing an important piece of evidence that the latter was influenced by Islamic sources in designing his models for planetary motion.

Kennedy was also responsible for giving mathematical astrology the place within the history of Islamic astronomy that it deserves. Besides the astrological chapter from the *Khāqānī Zīj*, he published a number of studies on smaller treatises and on astrological concepts, as well as a facsimile and translation with commentary of the astrological history

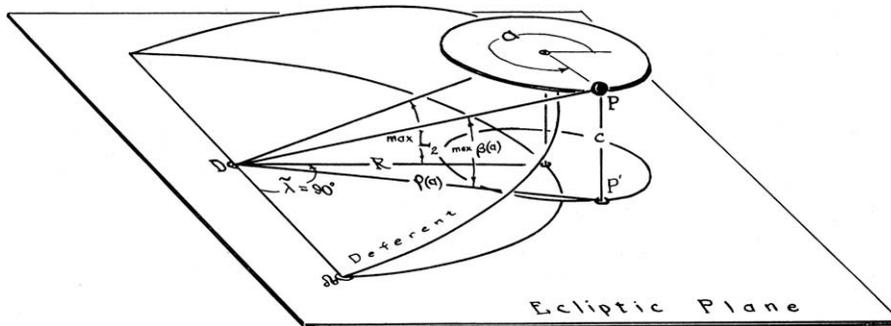


Fig. 1. Fig. 4a from E.S. Kennedy, “A Survey of Islamic Astronomical Tables”, *Transactions of the American Philosophical Society* 46 (2) (1956) 123–177, p. 149.

of the 8th-century scholar Māshā'allāh (together with David Pingree). The final publication on which Kennedy worked, an edition and translation of Battānī's (ca. 900) astrological history of Islam, will appear in the journal *Suhayl* in the course of 2010.

Of Kennedy's numerous other important publications on different topics I can here mention only very few. Together with Fuad I. Haddad and David Pingree he published the 9th-century *Book of the Reasons Behind Astronomical Tables* by al-Hāshimī, an invaluable source for the earliest history of Islamic astronomy and its influences from India and Persia. Kennedy's collection of databases of parameters found in Islamic astronomical sources also led to the publication of the geographical coordinates found in 40 Arabic and Persian works, many of them *zījes*. In 1999, together with Paul Kunitzsch and Richard P. Lorch, he published the highly complicated treatise on the melon astrolabe by Ḥabash al-Ḥāsib (9th c.). All in all, Kennedy published 10 monographs (including seven publications of sources) and over 100 articles, nearly all of which were reprinted in *Studies in the Islamic Exact Sciences* (American University of Beirut, 1983) and *Astronomy and Astrology in the Medieval Islamic World* (Variorum, 1998). His publications are characterized by a crystal-clear, didactical style of writing and wonderful hand-drawn geometrical figures (for an example, see Fig. 1). A full bibliography, extending the one published in the 1987 Festschrift mentioned in footnote 2, will appear in volume 9 of *Suhayl*.

Ted Kennedy was not only one of the most important scholars in the field of Islamic mathematical astronomy, who paved the way for an Islamic branch of the Neugebauer school of study of the pre-modern mathematical sciences, but he was also an extremely friendly and modest person, who would never hesitate to share his knowledge with colleagues and let students publish joint research under their own names. Having himself introduced the systematic use of the digital computer in technical research on the history of pre-modern astronomy, he was still very eager in his eighties to learn the PC software that had been newly written for the analysis of Islamic astronomical tables. Ted's wife Mary Helen Scanlon, with whom he had three children, was his inseparable companion for the last 60 years of his life. Without her, Ted would not have been able to do much of the work that he accomplished. It was also Mary Helen who made it possible for me to visit the Kennedys a number of times to profit from Ted's knowledge and experience as well as from his valuable library and card indexes. This started with a visit to Frankfurt am Main in 1987, and continued with various later ones to Princeton and Doylestown. I will forget neither the long days of fruitful work with Ted, which would usually end with me being exhausted long before he “called it a day”, nor the “constitutionals” through the lanes of

Princeton or the Doylestown park, the pleasant chats at lunch and dinner, and many of Ted's famous stories, most notably the one about how he slept through the Japanese attack on Pearl Harbour on his way from the US to Iran in 1941.

Kennedy's death at the age of 97 marks the end of an era. With the discontinuation of the Department for the History of Mathematics at Brown University after the death of David Pingree in 2005 and the closure of the Institute for History of Science in Frankfurt am Main after David King's retirement in 2007, the only remaining center in the western world where coordinated research on Islamic mathematical astronomy is still being carried out is the Arabic Department of Barcelona University. It can only be hoped that the significant position of the Islamic exact sciences within the general history of science will be more appreciated again in the future, so that a larger number of the many thousands of unstudied Arabic and Persian astronomical sources can be investigated and understood by the solid mathematical means introduced for this purpose by Edward S. Kennedy.

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