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(*b*, Nashville, Missouri, 2 November 1885; *d*. Boulder, Colorado, 20 October 1972)

astronomy.

Shapley was born in a farmhouse near Carthage, Missouri, the son of Willis Shapley, a farmer and schoolteacher, and Sarah Stowell. He received the equivalent of a fifth-grade education in a nearby rural school, and later took a short business course in Pittsburg, Kansas, *Daily Sun*, and a year later worked briefly as a police reporter in Joplin, Missouri, Determined to qualify for college, he and his younger brother John applied to the high school in Carthage, but they were turned down as unprepared. Instead, they attended the Presbyterian Carthage Collegiate Institute, from which Harlow graduated after two semesters. (Although Harlow's intellectual ambition was not shared by his twin brother, Horace, his younger brother John became an eminent art historian.)

In 1907 Shapley enrolled at the University of Missouri, intending to enter the projected School of Journalism, only to find that the school would not open for another year. Consequently, he took up astronomy almost by accident. Shapley's choice of astronomy was reinforced in his third year when Frederick H. Seares, director of the Laws Observatory, offered him a teaching assistantship. After three years at the university, Shapley received a B.A. with high honors in mathematics and physics in 1910 and an M.A. in 1911. When recommending him for the Thaw fellowship in astronomy at Princeton, Seares mentioned Shapley's "phenomenal industry," his "independence of thought and a certain originality," and his "diversity of interest."

Upon receiving the fellowship in 1911, Shapley began working on eclipsing binaries with Henry Norris Russell, who became one of his closest friends and confidants. Their joint work, based on the use of new computing methods, for the first time yielded extensive knowledge of the sizes of stars. Besides the new methods of computing, Shapley used the polarizing photometer with the 23-inch refractor at Princeton, obtaining nearly 10,000 measurements. Within two years he had completed his doctoral dissertation. In an expanded version of his thesis, eventually published as a 176-page quarto volume in the *Princeton University Observatory Contributions*, Shapely analyzed ninety eclipsing binaries; scarcely ten orbits had previously been computed. Otto Struve later called this "the most significant single contribution toward our understanding of the physical characteristics of very close double stars."

As an important by-product of his research, Shapely disproved the commonly accepted opinion that Cepheid variables were binary stars. He showed that if the Cepheids were indeed double stars, the two components of their prototype, Delta Cephei, would have to fall inside each other. He therefore concluded that the Cepheid variables are not double but single stars that pulsate, thus changing their brightness as they change in size. Arthur Eddington carried out the theoretical analysis that made the pulsation hypothesis creditable but, as the extant correspondence reveals, there was always a close interaction between Shapley, the observer, and Eddington, the theoretician.

In 1913, as Shapley was finishing his thesis, he inquired about job prospects with Seares, who had left Missouri for the Mount Wilson Observatory. Seares arranged for Shapely to have an interview with George Ellery Hale, and shortly thereafter Shapley obtained a post at the California observatory. He did not go west immediately, but first took a five-month European tour with his brother John, and then stayed several months longer in Princeton to complete his monograph on eclipsing binaries. En route to Pasadena, on 15 April 1914, he married Martha Betz, whom he had met in a mathematics class at Missouri. Later she collaborated with Shapley on several papers and eventually became an expert in her own right on eclipsing binaries. The Shapley family grew to include a daughter and four sons.

The nature and direction of Shapley's research at Mount Wilson was foreshadowed by a visit he made to the Harvard College Observatory shortly before completing his graduate work at Princeton. There he discussed his future plans with Solon I.Bailey, who suggested that Shapley use the Mount Wilson sixty-inch telescope to study variable stars in globular cluster. It was precisely this suggestion that led to Shapley's most remarkable discoveries.

The globular clusters that became the focal point of Shapley's work are extremely remote and highly concentrated stellar systems, arranged in a spherical form and consisting of tens of thousands of stars. Before Shapley began his research at Mount Wilson. Bailey had already detected a number of Cepheid variables in the globular clusters. In addition, Henrietta Leavitt of Harvard had identified many variable stars in the two Magellanic Clouds. Her investigations indicated that the longer the periodic cycle of light variation, the brighter the star.

Shapley enlarged on Bailey's and Leavitt's work first by discovering many new Cepheid variables in globular clusters and second by devising a method of measuring distances to these clusters based on the relationship between Cepheid brightness and period. Before he could exploit this so-called period-luminosity relationship, Shapley had to calibrate the absolute brightness or luminosity of at least one Cepheid. Because no Cepheids are close enough to be measured by direct trigonometric methods, he relied on an ingenious statistical procedure to establish the distance and hence the luminosity of a typical Cepheid variable.

With his newly calibrated standard candle for the measurement of stellar distances, Shapley established a radically altered conception of the size of the Milky Way system. It is difficult to convey a sense of the intensive amount of work required to set up the magnitude sequences and to obtain the multiple plates needed to determine the periods of the variable stars. The fact that Shapley produced a series of eleven papers on star clusters before reaching his remarkable conclusions on galactic structure is indicative of the extraordinary number of hours devoted exclusively to data gathering. On 6 February 1917, Shapley wrote to the Dutch astronomer Kapteyn, who had been a regular visitor at Mount Wilson, that “the work on clusters goes on monotonously—monotonous so far as labor is concerned, but the results are continual pleasure. Give me time enough and I shall get something out of the problem yet.”

A year later, on 8 January 1918, Shapley wrote to Eddington about a new breakthrough:

I have had in mind from the first that results more important to the problem of the galactic system than to any other question might be contributed by the cluster studies. Now, with startling suddenness and definiteness, they seem to have elucidated the whole sidereal structure....

The luminosity-period law of Cepheid variation—a fundamental feature in this work—is now very prettily defined. It is based upon 230 stars with periods ranging from about 100 days to five hours. The measurement of the magnitudes necessary for the determination of the distances and space distribution of the clusters took a painful amount of stupid labor, but I am forgetting that for now we have the parallaxes of every one of them....

To be brief, the globular clusters outline the sidereal system, but hey avoid the plane of the Milky Way.... All of our naked-eye stars, the irregular nebulae, eclipsing binaries—everything we know about, in fact, and call remote, [belong to this system] except those compactly formed globular clusters, a few outlying cluster-type variables, the Magellanic clouds, and perhaps, the spiral nebulae. The globular clusters apparently can form and exist only in the parts of the universe where the star material is less dense and the gravitational forces less powerful than along the galactic plane. This view of the general system, I am afraid, will necessitate alterations in our ideas of star distribution and density in the galactic system.

The widely accepted view of the Milky Way in 1918 had resulted largely from the statistical work of Kapteyn. According to those laborious studies, the sun lay near the center of a flat lens-shaped stellar aggregation with the great majority of stars encompassed within a disk about 10,000 light-years in diameter. In contrast, Shapely maintained that Kapteyn’s system, containing most of the stars and clusters that we can see, constituted only a small part of a much larger galactic system that was centered within the remote congregation of globular clusters in the direction of Sagittarius. In writing to Eddington, Shapley indicated that the equatorial diameter of the system was about 300,000 light-years, with a center some 60,000 light-years distant.

Walter Baade later described Shapley’s achievement in his own picturesque way:

I have always admired the way in which Shapley finished this whole problem in a very short time, ending up with a picture of the Galaxy that just about smashed up all the old school’s ideas about galactic dimensions.

It was a very exciting time, for these distances seemed to be fantastically large, and the “old boys” did not take them sitting down. But Shapley’s determination of the distances of the globular clusters simply demanded these larger dimensions [*Stars and Galaxies*, p. 9].

Among the other very exciting things then going on at Mount Wilson was the discovery of novae in the spiral nebulae. At that time it was uncertain whether the spiral nebulae were satellites of our own Galaxy or “island universes,” that is, stellar systems comparable in form and structure to the Milky Way but located far beyond our galactic system. Shapley realized that if the luminosities of the novae were known, these stars could then provide a key to the distances of the spirals. In 1917 he suggested that the Andromeda nebula had a distance of some one million light-years, a measure close to the result now accepted. Yet, almost immediately, Shapley withdrew his statement. The reason for his action was twofold. First, Adriaan van Maanen at Mount Wilson had studied the proper motions of stars in spiral nebulae and had found that the spirals were rotating. His investigation of the spiral M 101 led to the conclusion that if this object were actually located at the distance indicated by its nova, it would be an enormous galaxy and hence its linear motions would be just incredibly large—an appreciable fraction of the speed of light. (Those who argued that the spirals lay outside the galactic system were obliged to consider van Maanen’s measures spurious, and subsequent research proved their view correct.)

By 1918 Shapley had a second reason for questioning the validity of the island universe theory. The Milky Way, as he had begun to envision it, was an enormous and lumpy structure that seemed to bear little resemblance to the spirals. He was loath to believe that the spirals could be comparable to the immense galactic system.

Shapley's indefatigable researching, speculating, and publicizing of his own views eventually led to the now famous debate on the scale of the universe presented before the National Academy of Sciences in Washington in April 1920. Throughout the encounter, Shapley maintained a cordial relationship with his opponent, Heber D. Curtis of the Lick Observatory, even though Curtis had written that the two speakers should go after each other "hammer and tongs." Shapley outlined his findings on the large dimensions of the Galaxy, presenting his points mainly in a nontechnical fashion. Curtis, on the other hand, spoke rather technically, trying his best to demolish Shapley's hypotheses about the luminosity of stars in globular clusters and to deflate the concept of a large distance scale for the galactic system. At the same time, Curtis argued quite correctly about the great distances of the spiral nebulae, a topic that Shapley tried to ignore. Before the debate there had been little direct communication between Shapley and Curtis, but for the joint publication, they freely exchanged working drafts. Hence Shapley's published version differs greatly from his comparatively popular oral presentation.

Shapley's alert and inquisitive nature led him to still other investigations on Mount Wilson. For example, he discovered a quantitative linear relation between temperature and the running speed of ants on the mountain, and he was always particularly proud of his five technical papers on ants in *Proceedings of the National Academy of Sciences*, *Psyche*, and *Bulletin of the Ecological Society of America*. Altogether, during his seven years at Mount Wilson he published over 100 papers.

Shapley's enthusiastic researching and his penchant for speculation sometimes led him astray. In the spring of 1918 he became excited about an explanation for the phenomenon of star streaming that completely missed the correct reasons. Ironically enough, it was the analysis of star streaming in terms of the rotation of our Galaxy, set forth by Bertil Lindblad in the 1920's, that provided one of the convincing finishing touches to Shapley's picture of the Milky Way.

While at Mount Wilson, Shapley had recognized that his own interests in variable stars and clusters were closely akin to the main concerns of the research programs carried out at Harvard under Edward C. Pickering's directorship, and he sometimes contemplated the possibility of becoming Pickering's successor. In his reminiscences Shapley wrote:

The day I heard that Pickering had died, on my way home for lunch, I stopped at the corner of two streats—I could name them now —and pondered on whether I should give up a research career. Should I, or should I not? Should I curb my ambition? Finally I said to myself, "All right, I'll take a shot at it" [*Through Rugged Ways to the Stars*, p. 82].

In fact, the directorship was first offered to Henry Norris Russell, who on 13 June 1920 wrote frankly to Hale at Mount Wilson Observatory:

If they accept this plan, I will then propose Shapley for second in command... consider what Shapley and I could do at Harvard!

Between us, we cover the field of sidereal astrophysics rather fully. We can both do some theory,—and I might keep Shapley from too riotous an imagination,—in print. Moreover, Shapley knows the field of modern photographic photometry and is familiar with big reflectors. He would have good ideas for the use of the 60-inch mirror which is at Harvard, but has never been utilized....

Shapley couldn't swing the thing alone, I am convinced of this after trying to measure myself with the job.... But he would make a bully second, and would be sure to grow—I mean in knowledge of the world and of affairs; if he grew intellectually he would be a prodigy!

In the end, Russell turned down the position, President Lowell of Harvard then offered Shapley a staff appointment, but not the directorship. When Shapley promptly declined the job, Hale informed Lowell that the Mount Wilson Observatory would grant Shapley a year's leave of absence if Harvard wished to make a trial arrangement. Lowell agreed, and in April 1921 Shapley took up residence in Cambridge; on 31 October he was awarded the appointment as full director.

At Harvard Observatory, Shapley immediately offered his encouragement for the completion and extension of the *Henry Draper Catalogue* of stellar spectral classifications, and with various collaborators, including Annie Jump Cannon and Lindblad, he began extensive researches into the distribution and distances of stars of various spectral types. Even while at Mount Wilson, Shapley had hoped to use the Harvard objective prism plates to determine spectrographically the distances of bright southern stars, but Walter S. Adams, the acting director, had made him return the plates on the grounds that it was inappropriate for a Mount Wilson staff member to use observational material from elsewhere.

At Harvard, Shapley seized the opportunity to study the Magellanic Clouds, the objects in the southern hemisphere in which the period-luminosity relation for Cepheids had first been established. Because Harvard Observatory had maintained a southern station for many years, photographic plates were already available, and Shapley in 1924 revised his earlier distance estimate for the Small Magellanic Cloud upward to 100,000 light-years, at that time the largest published distance for any object. Throughout his tenure as director, Shapley was always proud of the existence of a southern station, and with it he established a virtual monopoly on the study of the Magellanic Clouds. In 1927 the station was moved from Arequipa, Peru, to Bloemfontein, South Africa, and simultaneously Shapley persuaded the Rockefeller Foundation to provide a sixty-inch reflector for the new site. The giant emission nebula, 30 Doradus, in the Large Magellanic Cloud received special study, and in

1937 he and John S. Paraskevopoulos published photographs from the Rockefeller reflector that showed for the first time the obscured nuclear cluster of blue-white supergiants. They also identified the red (M-type) supergiants in the association.

In February 1924 Edwin Hubble wrote to Shapley about his discovery of two Cepheid variables in the Andromeda nebula, M 31. Shapley responded that the letter was "the most entertaining literature I have seen for a long time," and promised to send a revised period-luminosity curve. Shapley must have realized at once that the spirals were, after all, extremely distant objects. His research interests turned increasingly toward these nebulae, which he called galaxies. By the end of the decade a considerable rivalry developed with Hubble, who called the spirals "extragalactic nebulae," and these terms became shibboleths in an even broader competition between east coast and west coast American astronomy. The rivalry was exacerbated by the Rockefeller Foundation decision to sponsor a 200-inch telescope for the Mount Wilson Observatory; Shapley naturally had hoped for greater developement of his southern station.

Shapley's principal work on galaxies took the form of vast surveys that recorded tens of thousands of these objects in both hemispheres of the sky. His work showed not only the enormous numbers of galaxies but also their irregular disribution, a point he emphasized in contrast to Hubble, who tended to stress the homogeneity necessary for simple cosmological modeling. An early result of these surveys was the "Shapley-Ames Catalogue" of 1,249 galaxies, including 1,025 brighter than the thirteenth magnitude.

Shapley's major discovery of the 1930's, a consequence of the galaxy surveys. was the identification of the first two dwarf systems, in the southern constellations Sculptor and Fornax, both now firmly established as members of our local family of galaxies.

After leaving Mount Wilson, Shapley's greatest contribution was not so much any particular astronomical discovery, but rather the extraordinarily stimulating environment he created at the Harvard College Observatory. Camridge, Massachusetts, in the 1920's became the crossroad through which nearly every major astronomer passed, a status that culminated in the congress of the International Astronomical Union there in 1932. Cecilia Payne and Donald Menzel came to Harvard to pursue pioneering astrophysical problems, and Payne's doctoral thesis on stellar atmospheres, published as the first of the *Harvard Observatory Monographs*, was pronounced by Henry Norris Russell as the best he had ever read with the possible exception of Shapley's. Previously there had been no graduate program in astronomy at Harvard. Shapley quickly set about building a distinguished department whose alumni in turn became the leaders in other graduate programs throughout the country. Among the staff members Shapley brought to Harvard in the late 1920's to assist in building a graduate program were H. H. Plaskett and Bart J. Bok. The first Radcliffe and Harvard astronomy Ph,D.'s after Miss Payne, were Frank Hogg, Emma Williams, and Helen Sawyer. Graduates in the 1930's included peter Millman, Carl Seyfert, Frank Edmondson, Jesse Greenstein, and Leo Goldberg.

Under Shapley the Harvard Observatory be came a mecca for young astronomers throughout the world. In his early days there he became a confirmed internationalist, and during the late 1930's he helped rescue European refugee scientists and bring them to the United States. Bokreports, "One of these who came to Harvard [Richard Prager of Berlin] told me quietly and seriously that every night at least a thougsand Jewish scientists were saying a prayer of thanks for Harlow Shapley's humanitarian efforts to help save them and their families."

A brilliant and witty speaker, Shapley accepted numerous lecture assignments, including the Halley lecture in Oxford (1928), the Darwin lecture of the Royal Astronomical Society (London, 1934), and the Henry Norris Russell lecture of the American Astronomical Society (Haverford, 1950), aswell as popular lectures in churches and small colleges. His original insights dramatized the vastness of the universe and the peripheralness of man. A confirmed agnostic, he nevertheless frequently participated in conferences on science and religion and edited the book *Science Ponders Religion* (New York, 1960).

Shapley was the recipient of many honors, beginning with his election to the National Academy of Sciences in 1924 and the Draper Medal awarded him by the Academy in 1926. His other numerous awards included the Rumford Medal of the American Academy of Arts and Sciences in 1933, the Gold Medal of the Royal Astronomical Society in 1934, and the Pope Pius XI Prize in 1941. He became an honorary national academician in a dozen foreign countries , and won even more honorary doctorates. Shapley served as president of the American Astronomical Society (1943–1946), of the Society of the Sigma Xi (1943–1947), and of the American Academy of Arts and Sciences (1939–1944), which he was particularly instrumental in revitalizing.

After World War II, Shapley gave increasing priority to national and international affairs. Consequently, his effectiveness as an astronomer began to decline, and Harvard began to lose the leading position it had reached in astronomy during the 1930's, according to Bok, in his "Biographical Memoir of Harlow Shapley," in *Biographical Memoirs. National Academy of Sciences*. Bok adds that in retrospect it seems a pity that Shapley did not resign his directorship to assume some important administrative post in science commensurate with his role as citizen of the world.

One of Shapley's proudest achievements during the late 1940's was his role in the formation of the United Nations Educational, Scientific, and Cultural Organization. Kirtley Mather has written, "Shapley almost singlehandedly prevented the deletion of the 'S' from UNESCO." In 1945 Shapley was one of the Americans sent to London by the State Department to write the UNESCO Charter, and he firmly believed the opening lines: "Since wars begin in the minds of men, it is in the minds of men that the defenses of peace must be constructed."

In 1945 Shapley was Harvard's representative at the celebration of the 220th anniversary of the Academy of Sciences in Moscow. One of the few Americans permitted to visit the Soviet Union in that era, he became an outspoken champion of cooperation with Soviet intellectuals when such a view was becoming increasingly unpopular. For several years Shapley served as chairman of the Independent Citizens Committee of the Arts, Sciences, and Professions, an organization that helped raise money to support liberal candidates for Congress. In November 1946 he was subpoenaed by the House Committee on Un-American Activities. Congressman John Rankin, who had been sitting behind closed doors as a one-man subcommittee, emerged to state, "I have never seen a witness treat a committee with more contempt." A month later Shapley was elected president of the American Association for the Advancement of Science, a move interpreted as a rebuke to the committee and a vote of confidence in the Harvard astronomer. In the late 1940's Shapley made headlines when he chaired several meetings of left-wing organizations to which Russian delegates were invited. In March 1950 he was named by Senator Joseph McCarthy as one of five alleged Communists connected with the State Department, but later in the year Shapley was completely exonerated by the Senate Foreign Relations Committee.

Shapley continued as director of the Harvard College Observatory until the fall of 1952. In his seventies, he was still very active, giving much time to the grants committees of the Sigma Xi, and thoroughly enjoying himself as he traveled far and wide on lecture tours. Following his eightyfifth birthday, his strength began to fail rapidly. He moved to Boulder, Colorado, where his son Alan resided, and there he died in 1972.

A versatile and imaginative thinker with a vivid personality, Shapley made devoted allies and bitter enemies. His friends called him a Renaissance man and forgave his vanity, while even his detractors conceded that he was one of the most stimulating figures in twentieth-century science.

BIBLIOGRAPHY

I. Original Works. A. *Books and Articles*. An extensive bibliography of Shapley's writings (about 600 items), prepared by Mildred Shapley Matthews and based on an earlier version by Thomasine Brooks, will appear in *Biographical Memoirs. National Academy of Sciences*. Only his most noteworthy publications are listed here.

Shapley's doctoral dissertation was published as "A Study of the Orbits of Eclipsing Binaries," in *Princeton University Observatory Contributions*, no. 3 (1915). A related and pioneering paper was "On the Nature and Cause of Cepheid Variation," in *Astrophysical Journal*, **40** (1914), 448–465. Two dozen additional articles on binaries and variable stars appeared in *Astrophysical Journal* and *Publications of the Astronomical Society of the Pacific* during the years 1913–1916.

Shapley's Mount Wilson studies of clusters and galactic structure appeared between 1916 and 1921 primarily in two long series, "Studies of the Magnitudes in Star Clusters" (13 parts in *Proceedings of the National Academy of Sciences*) and "Studies Based on the Colors and Magnitudes in Stellar Clusters" (19 parts mostly in the *Astrophysical Journal*, but the first three only in *Contributions from the Mount Wilson Solar Observatory*); the most important of these studies are "Sixth Paper: On the Determination of the Distances of Globular Clusters," in *Astrophysical Journal*, **48** (1918), 89–124; "Seventh Paper: The Distances, Distribution in Space, and Dimensions of 69 Globular Clusters," *ibid*., **48** (1918), 154–181; and "Twelfth Paper: Remarks on the Arrangement of the Sidereal Universe," *ibid*., **49** (1919), 311–336. An excellent review of his early ideas on the arrangement of the Milky Way is "Star Clusters and the Structure of the Universe," in *Scientia*. **26** (1919), 269–276. 353–361, and **27** (1920), 93–101, 185–193.

His changing views on the nature of the spiral nebulae are revealed in "Note on the Magnitudes of Novae in Spiral Nebulae," in *Publications of the Astronomical Society of the Pacific*, **29** (1917), 213–217, and "On the Existence of External Galaxies," *ibid*., **31** (1919), 261–268. The famous Shapley-Curtis debate, in a much revised form, appears as "The Scale of the Universe," in *National Research Council Bulletin*, **2** . no 11; Shapley's argument is found on pages 171–193 and H. D. Curtis' on pages 194–217. Shapley's work on clusters cuminated in his monograph *Star Clusters* (New York, 1930), and in the extended summary "Stellar Clusters," in *Handbuch der Astrophysik*, **5** , part 2 (1933), 698–773. A later review of this work is "A Half Century of Globular Clusters," in *Popular Astronomy*, **57** (1949), 203–229.

While at Harvard, Shapley produced a series of eight articles on "The Magellanic Clouds," in *Harvard College Observatory Circulars* (1924–1925), and with Adelaide Ames, another series of five parts on "The Coma-Virgo Galaxies," in *Harvard College Observatory Bulletin* (1929). He also prepared, with Miss Ames, "A Survey of the External Galaxies Brighter than the Thirteenth Magnitude," in *Annals of Harvard College Observatory*, **88** , no. 2 (1932), commonly called the "Shapley-Ames catalogue." For descriptions of Shapley's vast galaxy surveys recorded in *Annals of Harvard College Observatory*, **88** , no. 5 (1935), and **105** , no. 8 (1938), see "A Study of 7900 External Galaxies," in *Proceedings of the National Academy of Sciences*, **21** (1935), 587–592, and "A Survey of Thirty-six Thousand Southern Galaxies," *ibid*., **23** (1937), 449–453. The discovery of the Sculptor and Fornax dwarf galaxies is announced in "Two Stellar Systems of a New Kind," in *Nature*, **142** (1938), 715–716. From 1939 to 1942 Shapley published the first sixteen pages of a series entitled "Galactic and Extragalactic studies," in *Proceedings of the National Academy of Sciences;* he completed the series finally with paper 23 in 1955.

At least as early as 1935 Shapley had outlined a proposed book on the structure of the Milky Way and the Magellanic Clouds, and had by 1948 planned a monograph solely on the Magellanic Clouds, and had by 1948 planned a monograph solely on the Magellanic Clouds. Although the work was never completed in this form, its development strongly influenced the scope of his

Galaxies (Philadelphia, 1943; rev. ed., Cambridge, Mass., 1961), in the semipopular Harvard Books on Astronomy series, as well as his Henry Norris Russell lecture to the American Astronomical Society in 1950 (summarized in "A Survey of the Inner Metagalaxy," in *American Scientist* **39** (1951), 609–628). The Russell lecture and a Sigma Xi lecture, "The Clouds of Magellan, e Gateway to the Sidereal Universe," *ibid*., **44** (1956), 73–97, were later expanded into *The Inner Metagalaxy* (New Haven, 1957). Among the research works synthesized in this volume was a series of seventeen papers, mostly by shapley, entitled "Magellanic Clouds," appearing in the *Proceedings of the National Academy of Sciences* between 1951 and 1955. See also "Comparison of the Magellanic Clouds with the Galactic System," in *Publications of the Observatory of the University of Michigan*, **10** (1951), 79–84.

Shapley wrote several distinguished popular books of essays on astronomy: *Starlight* (New York, 1926), *Flights from Chaos: A Survey of Material Systems from Atoms to Galaxies* (New York, 1930), *Of Stars and Men* (Boston, 1958), *Beyond the Observatory* (New York, 1967), and *The View from a Distant Star* (New York, 1963). The last of these volumes incorporates one of his most influential and widely reprinted essays, "A Design for Fighting," originally in *American scholar*, **14** (1945), 19–32. Another essay that Shapley held as one of his most significant was "Cosmography: an Approach to Orientation," in *American Scientist*, **42** (1954), 471–486.

Shapley prepared several anthologies including *A Source Book in Astronomy*, with H. E. Howarth (New York, 1929), and *Source Book in Astronomy 1900–1950* (Cambridge, Mass., 1960).

B. *Manuscripts*. The Harvard University Archives contains 216 archival boxes of Shapley's correspondence, manuscripts, and memorabilia. Under shelf mark HUG 4773.10 are filed the so-called personal papers deposited by Shapley and his family, with access and literary rights under the discretion of the Archives. Boxes la to 5d contain manuscripts including scientific papers and associated research, book typescripts, and radio scripts; found here also is the original manuscript of the 1920 debate with Curtis, as well as numerous other lectures. Boxes 23b and 23c contain early correspondence, mostly after Shapley's retirement from the Harvard Observatory directorship in 1952, is found in boxes 18a–23a. Other large blocks of correspondence and memoranda relating mostly to non-observatry committees and assignments (including political affairs) are found in boxes 10a–17d. Travel diaries and biographical materials are found in 25a–26c. The second group of boxes, ninety in all, shelf mark UA V 630.22, contain the observatory director's correspondence for 1921–1954, with access by permission of Harvard College Observatory. In this category can be found Shapley's voluminous correspondence with Henry Norris Russell, for example, plus letters to and from George Ellery Hale, Edwin Hubble, Adriaan van Maanen, and many others.

II. Secondary Literature. Shapley's book of autobiographical reminiscences, *Through Rugged Ways to the Stars* (New York, 1969), was produced from an oral interview, although with reliance on memories of an earlier anecdotal book that he researched but never wrote. (The original tapes are in the Niels Bohr Library, American Institute of Physics, in New York.) "It is not the very best of autobiographies, but it does show the true Harlow Shapley with all his wonderful ideals, his vanity, his compassion and his compassion and his greatness." writes Bart J. Bok in "Biographical Memoir of Harlow Shapley," in *Biographical Memories. National Academy of Sciences*, **48** (1976). An unpublished book-length biography has been written by Shapley's daughter Mildred Shapley Matthews. See also Bart J. Bok, "Harlow Shapley, Cosmographer," in *American Scholar*. **40** (1971), 470–474, and "Harlow Shapley–Cosmographer and Humanitarian," in *Sky and Telescope*, **44** (1972). 354–357. An extensive obituary appeared in *The New York Times*, 21 October 1972; see also hudson Hoagland, "Harlow Shapley–Some Recollections," in *publications of the Astronomical Society of the Pacific*, **77** (1965), 422–430.

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Owen Gingerich