Astron. Astrophys. 187, 1–11 (1987)

ASTRONOMY AND ASTROPHYSICS

New information on comet P/Halley as depicted by Giotto di Bondone and other Western artists

Roberta J.M. Olson [1] **and Jay M. Pasachoff** [2]

[1] Art Department, Wheaton College, Norton, MA 02766, USA
[2] Williams College-Hopkins Observatory, Williamstown, MA 01267, USA

Received January 26, accepted March 25, 1987

Summary. Artists' depictions of comets provide the only visual evidence of historical comets, most notably of Halley's Comet. In this paper we discuss the visual evidence of comet P/Halley at several passages through that of 1301 and compare it with descriptions and modern images. Since it was first recognized that Giotto di Bondone painted a comet in place of the Star of Bethlehem and suggested that this was a portrait of the 1301 apparition of comet Halley (Olson, 1979), a great deal of new information has come to light. We present a synopsis of the textual, visual, and astronomical evidence to support the theory that when Giotto painted his comet in the Scrovegni Chapel he was reflecting his viewing of Comet Halley in 1301.

Key words: comet P/Halley – art – historical – Giotto

1. Introduction

Artists' representations of comets provide the only visual evidence of historical comets, most notably Halley's Comet, before the advent of astronomical photography in the later nineteenth century. As such, they can furnish unique information about past apparitions that supplements astronomical observations and texts.

Artists' depictions also reveal contemporary attitudes toward celestial phenomena and reflect current scientific thought. There has been particular interest in the theory first advanced by one of us (Olson, 1979) that the object rendered as the Star of Bethlehem in a fresco by the Italian painter Giotto di Bondone was based on the 1301 apparition of P/Halley. Prior to that time none of the literature on Giotto had even mentioned that his Star was a comet. This identification led the European Space Agency to name its spacecraft to P/Halley "Giotto." The evidence for the identification is complex and indirect but strong; we argue the case below. Halley's Comet and other objects in the same series of frescoes were among the first to be painted in a naturalistic Renaissance manner, and the effect of the apparition of a bright comet on Giotto may have helped to push his art toward a more radical naturalism and thus played an important role in determining the future of art.

Send offprint requests to: J.M. Pasachoff

2. Discussion

2.1. *Halley's Comet–684*

While this stylized woodcut of 1493 (Fig. 1) purports to record the 684 A.D. apparition of P/Halley, the prickly form is repeated for subsequent comets in the text, and thus merely provides visual punctuation for the chronicle. This exact form is repeated once more; a related more horizontal form appears once; a form that is nearly but not quite its mirror image appears six times; and a form with a similar tail but with a cloud-like configuration for a head appears three times. This image is not, therefore, the earliest representation of P/Halley itself, and is significant only because it calls our attention to the fact that the apparition was recorded in a European source used by the later compiler. Chinese records also briefly report the apparition.

2.2. *Halley's Comet–1066*

The Chinese recorded this apparition as having a broom-like vapor, while the Korean Koryo-sa describes it as being as large as

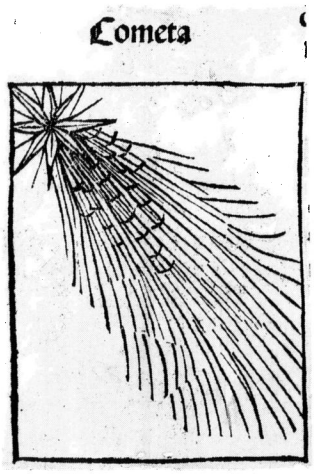

Fig. 1. *Halley's Comet of A.D. 684*, from Hartmann Schedel, the *Nuremberg Chronicle*, 1493, Latin edition. New York, Rare Books and Manuscripts Division, The New York Public Library, Astor, Lenox, and Tilden Foundations

Fig. 2. *Halley's Comet of 1066*, detail of the Bayeux Tapestry, 1073–83. Bayeux Town Hall. With special authorization of the Ville de Bayeux

the moon, which western sources also note (either because of a common source or similar rhetorical judgments, or as absolute judgments of its size). The cathedral archives at Viterbo, Italy, record it as having a tail streaming like smoke up to nearly half the sky. Other westerners describe it rhetorically as "a torch of the sun" or a "flaming beam" – language that parallels the Romanesque stylizations of the Bayeux Tapestry (Fig. 2). These simplified cartoon-like forms endow the image with a symbolic power worthy of the accompanying inscription: *Isti mirant stellă* ("they are in awe of the star"). The comet, resembling a primitive rocket ship, does reveal its anatomical parts, albeit in stylized form: the coma, center of condensation, plasma tail, etc.

2.3. Halley's Comet–1145

Halley's Comet of 1145 is shown in this marginal notation by the monk Eadwine (Fig. 3a). Even though it is a line drawing, there is an attempt to show a head (including a nine-ray center of condensation) and some structure in the tail. In April 1986, Comet Halley exhibited a fan tail (Fig. 3b) similar to Eadwine's line drawing, suggesting that the apparently stylized drawing might have been roughly based on the comet's shape.

2.4. Halley's Comet–1222

A comet (*STELLA COMMETA*) occurs on the right side of an archivolt of Piacenza Cathedral (Fig. 4), usually dated c. 1222 on stylistic grounds. The date should be considered the *terminus post quem*, for 1222 was the year of a spectacular apparition of P/Halley. It would explain why the comet is featured in such an unusually prominent position, balancing the star (*STELLA*), symbolizing all the fixed stars of heaven, found on the opposite side of the moon, the hand of God, and the sun. Datei (1983) posited that a fresco fragment of c. 1250 in the Palazzo della Ragione, Mantua, preserves the 1222 apparition of P/Halley, but this is very unlikely (see Olson and Pasachoff, 1986).

2.5. Halley's Comet–1301

P/Halley was recorded in 1301 in Europe by several individuals, including the eminent historian Giovanni Villani, who describes "great rays of fumes behind [con grandi raggi di fumo dietro]." According to him (Villani, c. 1308–48), the comet remained visible until January 1302 ("durò infino al gennajo"), although it is generally agreed that it remained visible from at least 16 September to about 1 November. Its perihelion was October 25th.

The comet's close approach to Earth and its resulting spectacular nature may partially explain why this is the first apparition of Halley's, or of any other comet for that matter, to have inspired a visually convincing portrait. While the time was artistically and intellectually ripe for such an accomplishment, it took the proclivities of Giotto di Bondone, the Florentine pioneer of naturalism, to observe the naked-eye apparition, translate his sensual experience into this image, and thus shatter the schematic artistic conventions for representing comets.

Giotto painted his comet in place of the customary Star of Bethlehem/Epiphany in the Adoration of the Magi scene in the Scrovegni Chapel in Padua about 1303–5, as part of an ambitious fresco cycle (Fig. 5). This in no way implies a belief that Halley's Comet was the historical Star of Bethlehem/Epiphany. Hughes

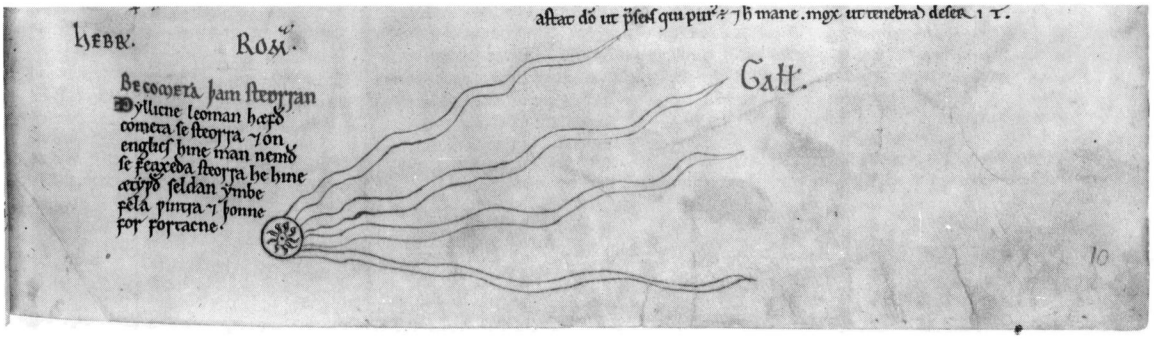

Fig. 3a. Eadwine, *The 1145 Apparition of Halley's Comet*, *The Eadwine* (*Canterbury*) *Psalter*, Ms. R. 17.1, Fol. 10r. Cambridge, Trinity College Library. Courtesy of the Master and Fellows of Trinity College

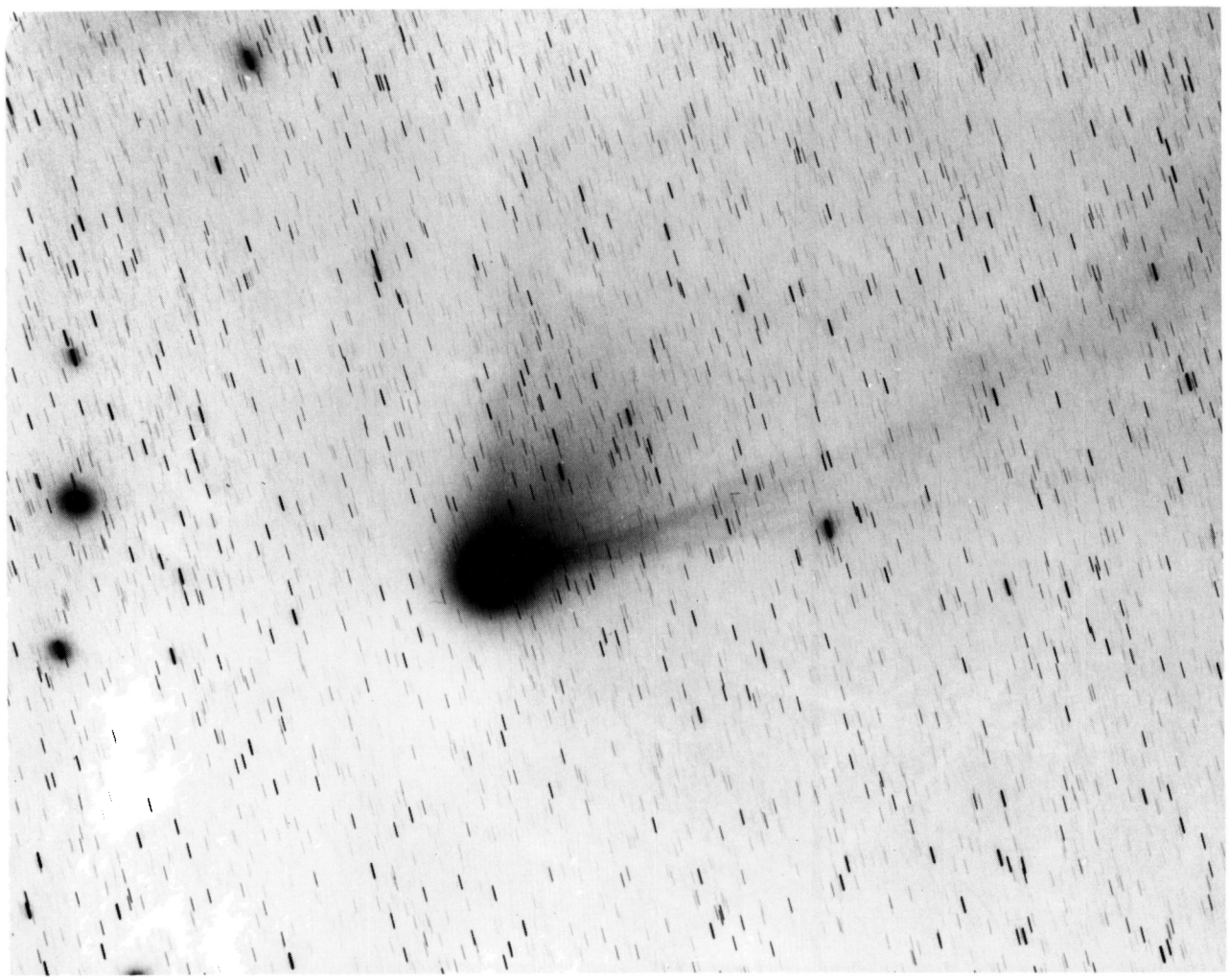

Fig. 3b. *Halley's Comet in April 1986*, photographed at Mauna Kea by Dale P. Cruikshank, Marc Buie, Heidi Hammel, and Alex Storrs

(1979) summarizes the history of the identification of the Star of Bethlehem/Epiphany with astronomical events, concluding that it was an actual physical object explicable by scientific law. (To further complicate the matter two different stars/lights are indicated in the *Apocrypha* – one for the Nativity and a separate one for the Adoration.)

The Star is usually depicted as a tiny stylized object, often with rays descending from it that point to the Christ Child to signify God's blessing of the event (Fig. 6). A rarer visual tradition for representing the Star of Bethlehem/Epiphany as an unusual star existed in Italy before Giotto, as seen in an eleventh-century manuscript page with its bizarre heavenly configuration or in a

Fig. 4. Attributed to Niccolò, detail of the Zodiacal Cycle on the central west portal, Piacenza Cathedral, c. 1222. F.lli Manzotti

Fig. 5a. Giotto, *The Adoration of the Magi*, 1303–5, fresco, 78 3/4 by 72 3/4 in. Padua, The Scrovegni Chapel. Alinari/Art Resource, New York

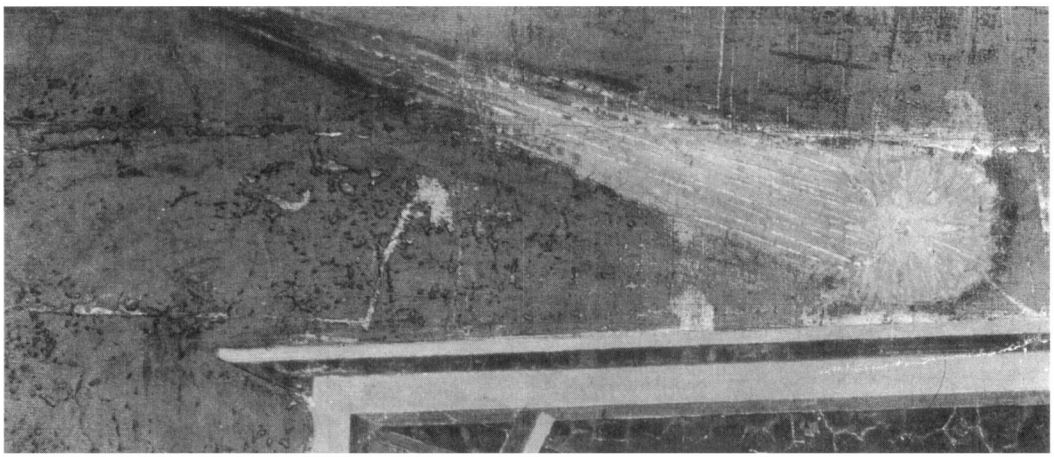

Fig. 5b. Giotto, *Halley's Comet of 1301*, detail of Fig. 5a

Fig. 5c. *Halley's Comet in 1986*, photographed by David Malin, © 1986 Anglo-Australian Telescope Board

Fig. 6. Duccio, detail from the *Maesta*: *Nativity with the Prophets Isaiah and Ezekiel*, tempera on panel, 1308–11. Washington D.C., The National Gallery of Art, Andrew W. Mellon Collection (1937.1.8)

Fig. 7a. *Initial with the Adoration of the Magi from the Gradual of St. Stefano*, Codex 123, F. 40, 51v, 11th. c. Rome, Biblioteca Angelica. Garrison Collection, Conway Library, Courtauld Institute of Art.

Fig. 7b. *Adoration of the Magi*, Codex 541, 13th c. Padua, Biblioteca del Seminario

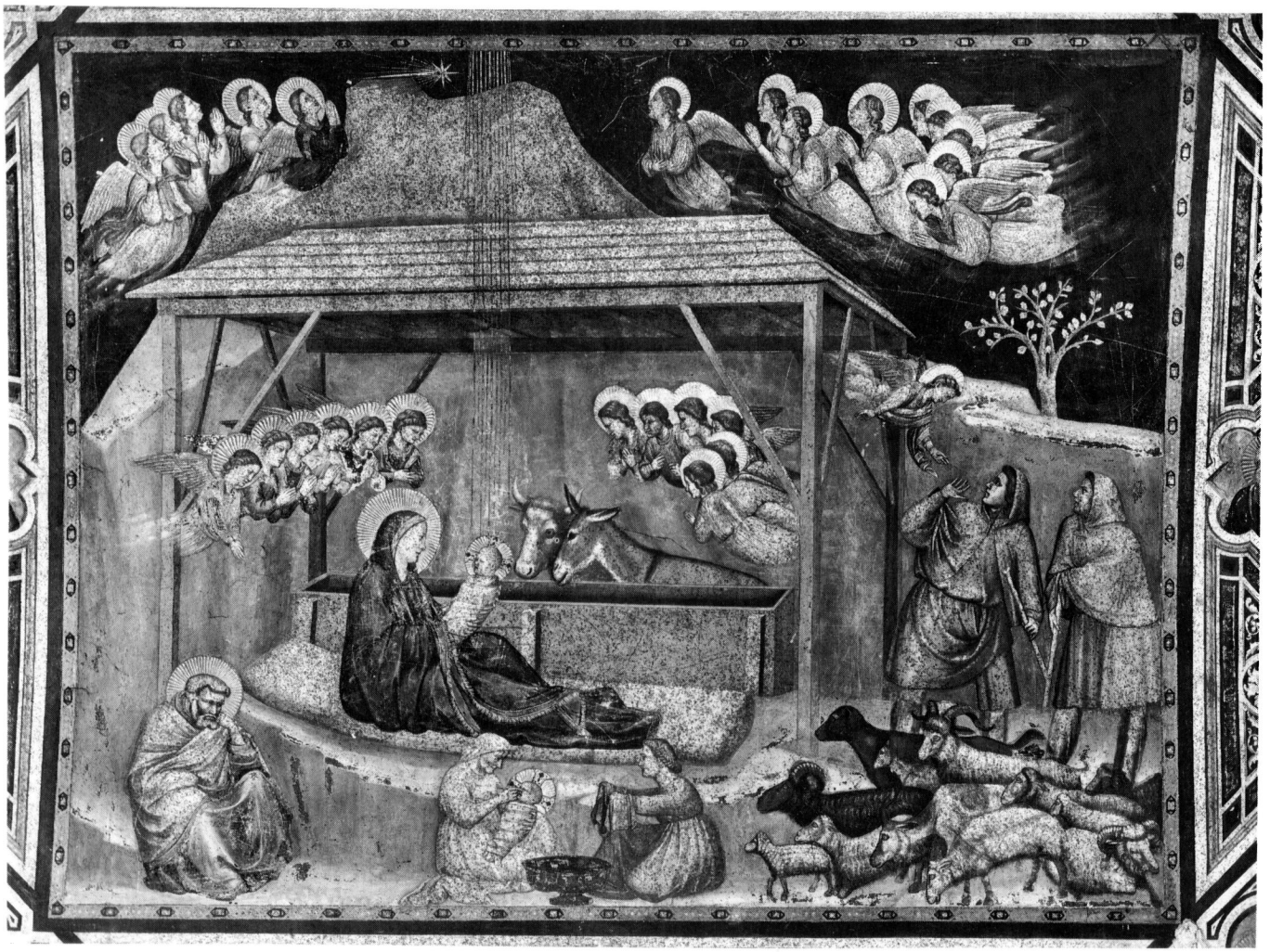

Fig. 8. Follower of Giotto, *Nativity*, c. 1316, fresco. Assisi, San Francesco, Lower Church. Alinari/Art Resource, New York

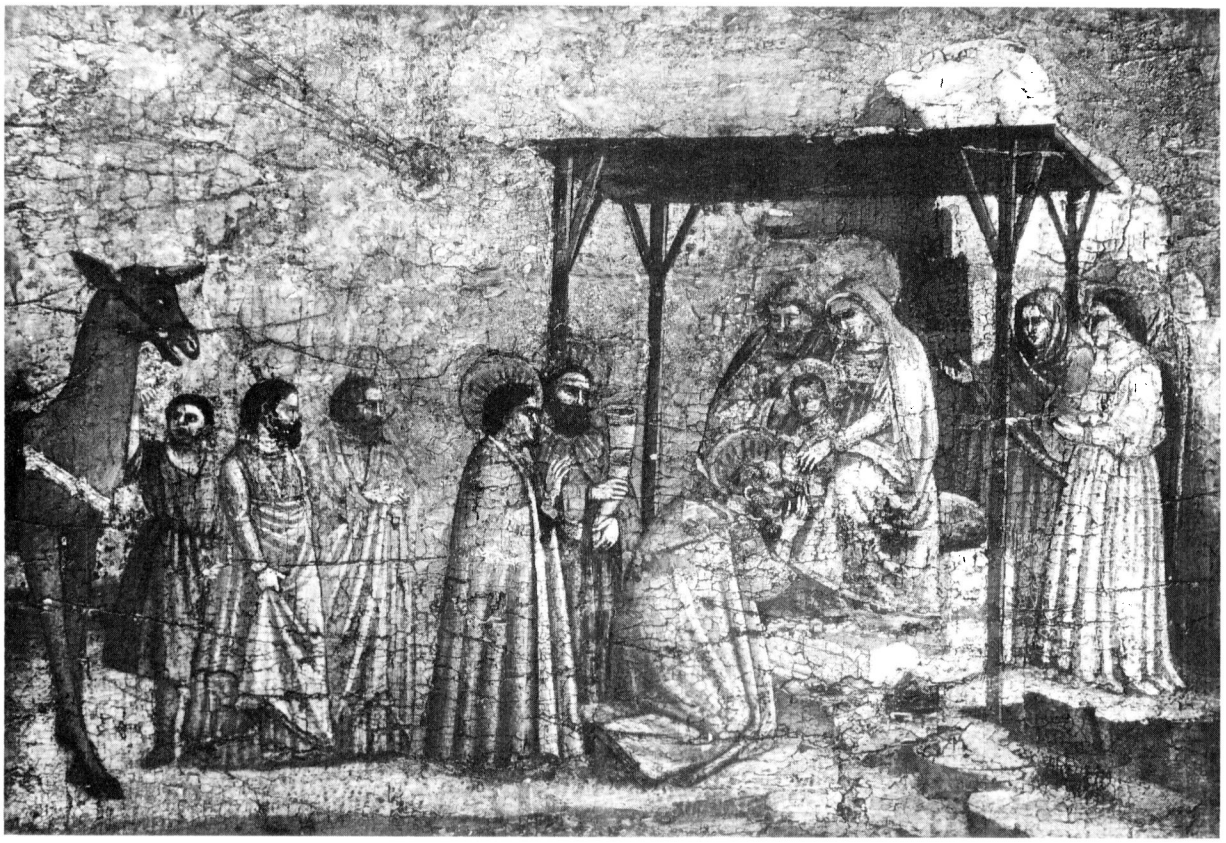

Fig. 9. Contemporary of Giotto, Copy of *The Adoration of the Magi*, tempera on panel. Whereabouts unknown

thirteenth-century manuscript with its more standard star (Figs. 7a and 7b). Significantly, neither depicts a comet.

By contrast, Giotto's fresco contains the first unambiguous comet in an episode from the Infancy of Christ cycle. Moreover, Giotto's revolutionary, large comet is more or less anatomically correct; that is, it shows the head and tail of the comet as it might have appeared to the naked eye. It is thus viscerally convincing.

Giotto created its center of condensation by building up layers of red, yellow, and gold pigment in the comet's head. Beneath the glowing center of condensation and reaching out into the coma are traces of an eight-point gilt star. This configuration may be either a *pentimento*, a first more conservative idea for the Star that the artist converted into a comet, or may be an integral part of his visualization of the coma. (Comets have frequently been described as having a star-like head.) The strong red coloration may be partially due to the flaking tempera pigments and red bole adhesive. But red was also an important ingredient in the artist's original palette. It is significant that historical comets, including Halley's, have been described as having a red cast.

The image's immediacy is heightened by Giotto's method of painting the sweeping arc of the tail. Giotto's technique thus successfully imparts the impression the comet might have given to the naked eye. No contemporary description provides this kind of veracity, strongly suggesting that Giotto's image could not have been rendered without careful firsthand observation. Giotto's magnificent comet dominates the Adoration scene. Because he included a historical comet, which his viewers would have also seen, he enhanced the contemporary impact of his painting and encouraged them to identify with the strong emotion and significance of the scene. For they too had recently witnessed the awesome apparition of P/Halley in 1301.

By including the naturalistic comet in this Adoration scene, Giotto was true to his humanistic method demonstrated most tightly in the Scrovegni Chapel. That is, in each scene of the fresco cycle he painted one or two familiar objects with such authenticity that his audience could immediately associate with their tangibility. Furthermore, each of these objects usually had a profound symbolic dimension. So too with the comet.

Though there has been much debate over what the Star of Bethlehem might have been – a conjunction, a comet, a supernova, etc. – it may well be that there was no actual astronomical event. The idea of the Epiphany Star (epi = above; phanos = appearance) certainly owes its origin to the pagan belief that the birth of a king was signaled by a comet, and follows a complex literary, theological, and astrological tradition. Depictions of the Star usually follow the written traditions (including Matthew 2:2; 2:9–10, the only Evangelist to mention the Magi's Star) rather than making astronomical statements. Giotto's choice of a naturalistic depiction would not have disagreed with any fourteenthcentury beliefs. It seems to follow Origen, the early Church Father, who is the only writer to actually state (*Against Celsus*, I, 59) that the Star was a comet (Olson, 1979, and Olson and Pasachoff, 1986). Thus an important textual source exists as a theological justification for Giotto's image.

Giotto was able to paint such a progressive, daring image of the comet because of the private status of the Scrovegni Chapel and the nature of the city of Padua. Because it was a family chapel, more artistic and theological license was allowed. In planning the

Fig. 10. Follower of Giotto, *Adoration of the Magi*, tempera on panel. New York, The Metropolitan Museum of Art, John Stewart Kennedy Fund, 1911 (11.126.1) (The Museum experts believe the comet is a nineteenth-century repaint; there is a *pentimento* of a star just above and to the left.)

program of the cycle Giotto consulted at least one theological advisor, although his identity is unknown. Furthermore, the Scrovegni Chapel was located in Padua, the university town where Galileo would eventually hold a chair. Already during Giotto's time the university was noted for the study of mathematics and was a center for nascent astronomy. Certainly Giotto and/or his patron and his theological advisor had access to some of the latest theories about the heavens.

It has been suggested (Bellinati, 1981, 1985) but not proven that Pietro d'Abano, the philosopher, medical doctor, and astrologer, was influential on both Giotto's naturalism and on his specific image of the comet. Since Giotto was a Florentine, his naturalistic aesthetic was formed long before his sojourn to paint for Scrovegni and reflects instead the ambience of Florence and Rome. D'Abano, following Aristotle and Ptolemy, had written that comets are dry and hot atmospheric exhalations and that "After a great fire, the material loses its red color and is tinged black." Bellinati believes that this brief description rather than the actual apparition of P/Halley in 1301 accounts for Giotto's powerful comet. He also does not account for the technical problems of the fresco that have resulted in its present appearance. His correlation is problematical, especially since d'Abano is not

Fig. 11. Jacopo Gradenigo, *Scenes of the Infancy of Christ*, Ms. 78 C. 18, Fol. 4r. Berlin, SMPK, Kupferstichkabinett

known to have returned to Padua from Paris until 1306 or later, probably too late for an encounter with Giotto (Gaudenzio, 1962).

More significant for Giotto's image of the comet is the apparent theological controversy of Giotto's time surrounding the nature of the Star. It is, for example, already encountered in a vernacular form in Jacobus de Voragine's *Golden Legend* of 1298. The churchman F. Giordano da Rivalto (born 1260) wrote that the Star of Bethlehem was not like other stars in the sky, for it did not follow the same path as the other stars. Rather, it was a new star. He specifically states that it was *not* a comet, revealing that the nature of the Star of Bethlehem was a hotly debated topic at the time when Giotto painted his image, and that Origen's linkage of that Star with a comet was well-known.

Throughout Italy in the popular tradition – i.e., in Nativity (*presepio*) scenes erected in churches and sacred plays (*sacre rappresentazioni*) thought to have influenced Giotto in the Scrovegni Chapel – the Star is today frequently shown as a comet. Parts of these practices date back to before Giotto's time, but it is difficult to trace the exact features and origins of the ephemeral events.

Giotto's comet was such an advanced artistic/scientific statement that it was followed by less than a handful of tiny, timid imitations by his school, but by enough of them to suggest that Giotto's comet had a very special impact. While these diminutive comets echo the literary/theological traditions, they do not preserve Giotto's naturalistic features, proving that Giotto's inspiration was his own experience of a comet and that his model was Halley's Comet of 1301. For example, followers of Giotto painted two minuscule comets in the Nativity (Fig. 8) and Adoration of the Magi scenes in the Lower Church of San Francesco, Assisi, about 1316. The singular nature of Giotto's image is underlined by looking at another fourteenth-century artist's copy of his Adoration scene (Fig. 9), and at a panel by a follower of Giotto depicting the Adoration (Fig. 10), wherein stylized comets appear instead of Giotto's naturalistic portrait. A grand but diverse stylized comet with an angel occurs in an Infancy of Christ scene in a manuscript by the Paduan Jacopo Gradenigo of around 1399 (Fig. 11); the angel-comet derives from the Infancy Gospel of the *Apocrypha*.

Giotto's interest in convincing celestial phenomena was bequeathed to one of his most talented pupils, Taddeo Gaddi, who is recorded to have been partially blinded by an eclipse. A reflection of Taddeo's physical and emotional trauma is found in his Annunciation to the Shepherds scene in Santa Croce, Florence, where an unusual light, emanating from the angel and synonymous in medieval-Renaissance symbolism with God, permeates the fresco, and one shepherd shades his eyes to gaze up at it in an attempt to penetrate its meaning. The quality of the light and the shepherd's gesture convincingly argue that this preserves Gaddi's autobiographical experience of an eclipse (Smart, 1977).

Based on documentary evidence, the recent art historical literature dates the Scrovegni frescoes, and certainly the section in which the Adoration occurs, before the 25 March 1305 consecration of the chapel (e.g. Bellinati, 1967, and Stubblebine, 1969). The consecration occurred on the feast of the Annunciation, the festival of the Annunciate Virgin, to whom the chapel is dedicated.

Between at least 1300 and 1305 there were no other spectacular comets to rival P/Halley in 1301, although Maffei (1984) raises the possibility of a second comet in late 1301. He bases his theory on old evidence, usually not given much credence, citing: (1) Pingrés later eighteenth-century work listing a second comet that appeared in December 1301 for only 15 days; and (2) Villani's claim that the 1301 comet appeared in September and lasted until January. Maffei believes that both Villani and Giotto may have conflated the two comets Pingré posited. A similar situation occurred in 1910, when Halley's Comet (1910II) was conflated with the earlier Great Comet (1910I). The so-called "second comet" of 1301 has never been confirmed and its apparition is questionable. (In a forthcoming study, we will evaluate Pingré's sources.) Many of the reports of comets during Giotto's time are unreliable and false, pure inventions or misunderstandings of other celestial phenomena. Lancaster-Brown (1985), in an undeveloped essay, also suggested a second comet in 1301. He questionably based his suggestion once again on much later authorities (J. Hevelius, *Cometografia*, 1668; S. Lubieniecki, *Theatrum Cometicum*, 1666–68; N. Stryck, *Algemeene Geographie*, 1740; A.-G. Pingré, *Comètographie*, 1783), who cite each other as evidence as well as other later sources to compound the confusion. While Lancaster-Brown stated that there is no way to determine which comet influenced Giotto, he questionably concluded that a second comet, appearing around Christmastime, would be better suited to Giotto's purpose. It seems to us that the time of the year when Giotto saw a comet would not have had a bearing on his including it. Its duration and brillance would have been far more important.

Marsden (1986), in his catalogue of comets whose orbits are known, as well as comet catalogues from the early part of this century list only P/Halley for the year 1301. (Modern catalogues

list only those comets whose orbits have been calculated.) Though it remains possible that a second comet could have appeared and disappeared in 1301 without returning to have its orbit calculated, it seems more likely to us that the appearance of Comet Halley at different times in the morning and evening sky were noted as two comets, as frequently occurred until into the seventeenth century.

3. Discussion

Despite a literary tradition and contemporary trends, Giotto could not have painted his unprecedented portrayal of the Star as the vivid comet he rendered without experiencing firsthand a spectacular apparition. No written word or visual prototype can explain its revolutionary nature. The literary tradition and the fledgling zeal of the time for the observation of natural phenomena, rather, created a receptivity in both Giotto and his audience for such a seminal image.

Naturalism was resuscitated in the visual arts for the first time since Antiquity by Giotto about the time of the 1301 apparition of Halley's Comet (Boccaccio, c. 1350, and Vasari, 1568). The excitement of its apparition led Giotto to paint his comet with great immediacy, stimulating a more naturalistic style and imparting astronomical realism. Analogous but less intense responses are found with other objects that Giotto painted from life in the frescoes. Certainly of all the physical objects that the artist included, the comet was the most unusual and challenging. It could be that Halley's Comet itself inspired Giotto to take greater strides in his new naturalistic manner of painting. We present a fuller discussion of artists' depictions of Halley's Comet in Olson and Pasachoff (1986) and discuss the assessment of the accuracy of artistic depictions by comparing them with photographs in Pasachoff and Olson (1986).

Giotto's comet was, surprisingly, not equalled in painting until the nineteenth century and not surpassed until the advent of astronomical photography in the late nineteenth century. Giotto's galvanizing image received the highest compliment imaginable when the European Space Agency used the name "Giotto" for their mission to encounter the very comet that Giotto saw 685 years earlier.

Acknowledgements. Some of the photographs are courtesy of The National Air and Space Museum, Smithsonian Institution, Washington, D.C., from the book *Fire and Ice: A History of Comets in Art* by Roberta J.M. Olson.

This work has been supported in part by a grant from the National Geographic Society; by the Dudley Award of the Dudley Observatory.

We thank Brian G. Marsden and Donald K. Yeomans for calculating orbits for us. We appreciate the assistance of Elizabeth Stell, Scott McGuire, and Joan Silva with the manuscript. We are further grateful to Robert Volz of the Chapin Library of Williams College for his assistance and to Professor Ulrich Middeldorf for his suggestion.

References

Bellinati, C.: 1967, *La capella di Giotto all'Arena*, Padua, Tipografia del Seminario di Padova, 9–10

Bellinati, C.: 1981, *Jesus*, III [December], 50 ff

Bellinati, C., et al: 1985, *Magico Appuntamento/Halley e Giotto nel Cosmo*, Castel di Godego, *mp*/edizioni, 81–85

Boccaccio, G.: 1976 (c. 1350 original), *Decameron*, Florence, L'Accademia della Crusca, 6th day, 5th story

Datei, E.: 1983, *Astronomia* **23** [June], 30–34

Gaudenzio, L.: 1962, *Pietro d'Abano*, Abano, Azienda Autonoma di Soggiorno e Turismo

Hughes, D.: 1979, *The Star of Bethlehem: An Astronomer's Confirmation*, New York, Walker and Company

Lancaster-Brown, P.: 1985, *New Scientist*, 13 June, 29

Maffei, P.: 1984, *La Cometa di Halley*, Milan, Biblioteca EST/Mondadori, 217–227

Marsden, B.G.: 1986, *Catalogue of Cometary Orbits*, Cambridge, Mass., International Astronomical Union, 8

Olson, R.J.M.: 1979, *Scientific Amer.* **240** [May], 160–170

Olson, R.J.M., Pasachoff, J.M.: 1986, in *Proceedings of the 20th ESLAB Symp.: Exploration of Halley's Comet*, III, Paris ESA SP-250, 201–213

Pasachoff, J.M., Olson, R.J.M.: 1986, *Bull. Am. Astron. Soc.* **18**, 792

Pingré, A.-G., 1783, *Comètographie*, I, Paris, Imprimerie Royale, 423

Smart, A.: 1977, *Taddeo Gaddi, Orcagna and the Eclipses of 1332 and 1339*, in *Studies in Late Medieval and Renaissance Painting in Honor of Millard Meiss*, I, New York, New York University Press, 403–414

Stubblebine, J.: 1969, *Giotto: The Arena Chapel Frescoes*, New York, W.W. Norton and Co., 72–73

Vasari, G.: 1906 (1568 original), *Le Vite*, I, ed. G. Milanesi, Florence, G.C. Sansoni, 369–409

Villani, G.: 1802 (c. 1308–48 original), *Istorie Fiorentine*, IV, Milan, Società Tipografica, 71