MR1297546 (95m:01004) 01A35 (01A30)

★**Science in Western and Eastern civilization in Carolingian times.**

Edited by Paul Leo Butzer and Dietrich Lohrmann.

Birkhäuser Verlag, Basel, 1993. x+609 *pp.* $69.00. *ISBN* 3-7643-2863-0

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The central interest of the book is constituted by "computus" within the framework of Carolingian culture and scholarship. A number of articles provide contrast and context, presenting either other

cultures and periods (Byzantium, ʿAbbasid Islam, classical antiquity) or fields (from astronomy, numerology and recreational arithmetic to scholarship in general and agronomic science). Most papers are provided with extensive bibliographies.

Among the contributions dealing with the computus and related astronomical matters, the following are of particular importance: Arno Borst (pp. 53–78) treats "the collapse of Mediterranean time reckoning" in the 7th c.; the contrasting computus traditions and methods of Irish, Anglo-Saxon and Frankish scholars during the 8th c. (including the tardy acceptance of Bede's work on the Continent and its reasons); Charlemagne's and Alcuin's attempts at reform; and the creation of a great encyclopedia about the topic in three versions of increasing bulk, 793 (Verona?), 809 (Aachen?) and 818. McCluskey (pp. 139–160) distinguishes "at least four distinct astronomical traditions" in the early Latin Middle Ages: (i) Traditional folk astronomy, based on an observational solar calendar and dividing the year at solstices, equinoxes and the midpoints between these—the same division points which even conservative astronomical interpretations of the megalithic monuments find—and coupled to a lunar calendar. (ii) The arithmetical computus tradition, which in 7th-c. Ireland took over inspiration from this folk calendar; the main focus of the paper is to demonstrate the existence of this folk astronomy and its relation to the computus. (iii) Monastic observation of the stars, used to determine the time for prayers. (iv) The aftermath of Hellenistic geometric handbook astronomy based on geometric models, gradually coming to the fore in Carolingian times (but with a tendency to geometrise the heavenly movements as seen rather than an abstract model). Eastwood (pp. 161–180) investigates the details of the latter process, showing how information borrowed from the elder Pliny and Martianus Capella was reorganized and came into wide use via the 809 encyclopedia; Isidorean material, on the other hand, was only used in as far as it was found compatible with the prevailing tendency. Lohrmann (pp. 79–114) analyses the computistic-astronomical correspondence between Charlemagne and Alcuin, providing thus part of the background to the production of the 809 encyclopedia. Charlemagne's interest turns out to encompass astronomical phenomena in general and not only Easter reckoning. The correspondence also illustrates the clash between Alcuin and Charlemagne's counsellors in the matter, insufficiently respectful of the traditional according to Alcuin's taste. Wiesenbach (pp. 229–250) examines a star clock which Pacificus of Verona († 844) invented, showing it to consist of a sighting tube to be directed toward the polar star (of the epoch), and a disk that was oriented after a circumpolar star and calibrated at the fall of night. The instrument is argued convincingly to be identical with Gerbert's oralogium, which has been interpreted by earlier workers as a sundial, a waterclock, or an astrolabe. The invention is obviously connected to McCluskey's monastic tradition.

Among the other contributions on mathematical astronomy, these can be listed: Tihon (pp. 181–203) investigates the level of astronomical activity in eighth and ninth century Byzantium. The level of the eighth century appears to have been very low, but astrology called for some activity. During the ninth century Byzantine cultural renaissance, the *Almagest* and other treatises "were copied in beautiful manuscripts, but we do not know whether they were actually read or studied". Kunitsch (pp. 205–220) gives a survey of the pre-scientific "folk astronomy" of the pre-Islamic and early Islamic period (almost exclusively used in religious practice, however many treatises on the prayer times and the direction toward Mecca were written by mathematicians) and the Arabic-

Islamic scientific astronomy of the 8th–10th centuries. Emphasis is on the latter topic. Schlosser and Hoffmann (pp. 221–228) show—by an ingenious argument building on the latitude-dependent effects of airglow and other effects—that Ptolemy's description of the Milky Way corresponds to observation at Egyptian latitudes. No surprise, as commented by the authors, but still evidence that the observations were not made by Hipparchos at Rhodes nor in Rome or Babylon.

Other mathematical topics (including the "mixed mathematics" of earlier times, specifically mechanics and mathematical geography) are dealt with in these papers: Folkerts (pp. 276–281), basing himself on his 1978 edition of the work, tells briefly about the manuscripts and the contents of the *Propositiones ad acuendos iuvenes*, a collection of recreational problems ascribed to Alcuin. The occurrence of camels in two problems is supposed to support the ascription because of the diplomatic contact between the Aachen court and Baghdad; as observed by Sesiano (p. 432), a more plausible explanation is the conservation of ancient material. Folkerts and Gericke (pp. 283–362) give the Latin text of the same collection of problems prepared by Folkerts and translated into German by Gericke. The commentary is useful but does not much exceed what can be found in the work of S. Tropfke [*Geschichte der Elementarmathematik, Vol. 1*, de Gruyter, Berlin, 1980; MR0552517 (81j:01004)]. In internal cross-references in this paper, page numbers should be augmented by 283. Sesiano (pp. 399–442) delineates the character of Arabic mathematics from the 8th–10th c. After a brief depiction of the Mesopotamian, the Indian and the Greek legacies, the following single areas are dealt with through select examples: Algebra, calculating arithmetic, geometry, theoretical arithmetic, recreational arithmetic, and magic squares. As is natural, most of the survey summarizes familiar material, but part of it (inter alia the treatment of complex magical squares) builds on the author's own recent work (a fact which is not told clearly in the article). P. L. Butzer (pp. 443–481) gives a broad overview of mathematical and astronomical activity in the Latin, Byzantine, Monophysite and Islamic spheres from the end of antiquity until the early second millennium, telling the story through brief presentations of the works of individual scholars but in historical context. Hiscock (pp. 115–127) undermines the received argument that Charlemagne's chapel in Aachen was inspired by San Vitale in Ravenna, showing that the architectural similarities do not exceed what can easily be explained from shared sacred numerology as found in numerous texts from the epoch. Hill (pp. 485–502), after a portrayal of the general conditions of scholarly life in 9th-c. Baghdad, presents the activities in mathematics and astronomy briefly, after which a more detailed treatment of mechanical technology is given—in particular Banū Mūsā's *Book of ingenious devices*, from which two (verily ingenious) items are discussed in detail. Bergmann (pp. 525–537) investigates the Irish-born Dicuil's *Liber de mensura orbis terrae*, written shortly after Charlemagne's death. This work, rediscovered in the mid-nineteenth century and traditionally held to be nothing but a chaotic repetition of Pliny and other authorities, is shown to be an unusually critical work, meticulously stating the sources for the information given, presenting their mutual disagreements, and pointing out when the presumed facts of the authorities are either inherently implausible or outright wrong according to reliable contemporary observation.

Further biographic information on scholars of importance for the history of mathematics can be found in the papers by Fleckenstein (Alcuin), James (Alcuin), O Cróinin (various Irish scholars), Stevens (Walahfrid Strabo), Katsaros (Leo the Mathematician alias Leo the Philosopher [not the

Emperor Leo VI] alias Leo the Iatrosophist) and K. W. Butzer (Walahfrid Strabo).

Reviewed by *Jens Høyrup*