



Abdelhamid I. Sabra (ed. and trans.), prepared for publication by Jan P. Hogendijk, *The Optics of Ibn al-Haytham Books IV–V: On Reflection and Images Seen by Reflection*

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The present volume is the fourth landmark in a project to edit and translate Ibn al-Haytham's *Kitāb al-Manāẓir*, inaugurated by the late A.I. Sabra in the 1980s. It is preceded by the critical edition of the first three books (*maqālas*) in 1983; its subsequent translation in 1989; and the Arabic critical edition of *maqālas* four and five, completed in 2002, upon which the work under review is based. Sabra, a colossus of Islamic history of science, passed away in 2013, leaving a near-complete translation that has been brought faithfully to publication by Jan P. Hogendijk. The first three *maqālas* focus on direct vision, while the two at hand deal with reflection. Errors caused by reflection, as well as the topic of refraction through transparent bodies, are to be found in the final two *maqālas*, as yet unedited. This latest instalment in the edition and translation of *Kitāb al-Manāẓir* carries forward the high editorial and linguistic standards of its predecessors and is hopefully a portent of the project's long-awaited completion in years to come.

It is perhaps obvious that historians of optics will find this text indispensable. *Kitāb al-Manāẓir* has come to be widely recognized as the single most important medieval work on optics – an assessment often made in terms of its influence on European luminaries, from Roger Bacon to Descartes. It is worth emphasizing, though, that Ibn al-Haytham left a profound legacy in the Islamic world. Indeed, it is particularly important that anyone attempting a serious evaluation of the scope and transformation of the exact sciences in what is questionably referred to as 'post-classical' Islam pay attention to Ibn al-Haytham's entire corpus, including his language and the framing of his arguments.

Ibn al-Haytham is among Islam's earliest serious critics of Ptolemaic astronomy, outlined in his work *Shukūk 'alā Baṭlamyūs* (Doubts Concerning Ptolemy). That work lays the foundations for a logical assault on Ptolemy, one taken up with zeal by later astronomers at Maragheh like al-Ṭusi (d. 1274), and the celebrated Damascene astronomer and timekeeper Ibn al-Shāṭir (d. 1375). The extent to which the latter's programme, as pointed out by eminent historian of Islamic science George Saliba (*Journal for the History of Astronomy*, 1987 18(1)), is influenced by an emphasis on observation – and not, like some of his predecessors, an essentially Aristotelian cosmological impulse – may well have its roots in *Kitāb al-Manāẓir*, a text that is similarly characterized by its appeal to observation (*'irṣād*). That is, the development in the long-term of a primarily observation-led programme of astronomical enquiry in high medieval Islam, one as yet scarcely attended to by global historians of astronomy, cannot be critically assessed without understanding Ibn al-Haytham's magnum opus.

The work is of still wider importance; historians of physics and of scientific method will find this edition of the fourth and fifth *maqālas* a veritable treasure trove. The text is broadly characterized by a certain systematicity. Ibn al-Haytham tends to lead with

assertions, like those beginning the second chapter of the fourth *maqāla* outlining how light from ‘luminous bodies’ will reflect from the surface of ‘polished bodies’. We are then led to some preliminary experiments demonstrating these phenomena, before more protracted investigations of the ‘manner’ in which light behaves, complete with elaborate details of experimental set-up. The descriptions of experiments are regularly punctuated with ‘conclusions’ and interspersed with ‘explanations’. Chapter 3 of the fourth *maqāla* contains one such fascinating explanation, rooted in a consideration of parallels between ‘natural bodies’ and light (pp. 54–60). The mechanical analogy elucidates something of Ibn al-Haytham’s understanding of optical phenomena, explained in terms of its ‘extremely fast’ motion and the ‘resistance’ posed by polished bodies. We are also treated in the following chapter to a glimmer of Ibn al-Haytham’s tendency to ‘simplicity’ – that darling of positivistic histories of science – when he dismisses the extramission theory of vision on the ground that it is unnecessary to explain vision, and is therefore ‘useless and redundant’. The *longue durée* historian of method cannot afford to ignore this seminal work, the analysis of which is aided by an inspired editorial choice to include the headings and subheadings of Ibn al-Haytham’s first major medieval commentator, Kamāl al-Dīn al-Fārisī (d. 1319) in the body of the text.

It would also be fair to suggest that this most recent edition might excite the technically minded historian of science rather more than did the first. Those inclined to understand the history of science through a teleological lens might regard Ibn al-Haytham’s discussions ‘on visible properties’ – including a prolonged discussion of beauty – as irrelevant or vestigial aspects of his work. This includes, as highlighted by Saliba when reviewing the edition of the first three *maqālas*, a prolonged discussion of beauty (*Journal of the American Oriental Society* (1992) 112(3)). *Maqālas* four and five are decidedly more prosaic, and the latter presents a series of rigorous and carefully constructed geometrical arguments for locating reflected images. This includes Ibn al-Haytham’s own generalized solution to the so-called ‘Alhazen’s problem’, attempted by Huygens, among others, of finding the point of reflection on the surface of a spherical mirror. Sabra himself first translated the six related lemmas in a preliminary work of 1982 (*Archive for History of Exact Sciences*, 26). Of course, I would caution against any fragmentation or decontextualization of *Kitāb al-Manāẓir* if we are to reap the most in our understanding of the text’s historical and philosophical importance. Sabra himself was an energetic proponent of the need to investigate the philosophical trappings of Islamic science, predicated on a clear explication of its technical contents and a sustained curiosity about the relationship of the exact sciences with other areas of Islamic intellectual endeavour. In editing, translating and commenting upon Ibn al-Haytham, Sabra and Hogendijk have performed an enduring service to this study.

It is worth mentioning that the present volume lacks a detailed commentary, such as that accompanying the translated edition of the first three books. Nonetheless, the edition, on the whole, is excellent. The book offers useful, if somewhat crowded, codicological comment on the different manuscripts cited at the outset, complementing an equally useful table provided at the beginning of the previous volume. The glossary is comprehensive and thorough, and reveals an admirable consistency in translation. These and the provision of concordance notes (between al al-Fārisī’s commentary and the edited Arabic and Latin versions) will be greatly appreciated by the context-minded historian of science. Anyone looking to undertake analysis of this canonical text’s language, or to advance the study of its transmission, will find their path significantly eased by these editorial choices. At this point, I can only echo Saliba in hoping that subsequent attempts to edit and translate the remainder of *Kitāb al-Manāẓir* will be soon in coming.