Astronomy can offer a third dating option, over and above the analysis of lunar and Sothic dates, viz. the possibility of dating monuments using solar, lunar or stellar alignments depending upon the variation of stellar coordinates due to precession or the variation of ecliptic obliquity. For such analysis, astronomy on the horizon is the most relevant tool. The pioneering work in this area is Norman Lockyer’s *The Dawn of Astronomy*,¹ considered today by some archaeoastronomers as the first “serious” book in their discipline. The author made ample use of precession to date Egyptian temples to support the long chronology which was accepted in his day (Dyn. 1, ca. 5000 BC). When Egyptologists discarded such chronologies any possibility of their using archaeoastronomy as a chronological tool disappeared with it. In the 1970s Gerald Hawkins² reopened the discussion; although the topic was promoted by Edwin Krupp,³ there was no noticeable response from Egyptologists.

Astronomical alignments are either directed towards the horizon or towards lower zenithal distances, including alignments towards zenith pass. The latter has seldom figured in archaeoastronomical studies, although it has the advantage of offering fewer problems. But its existence is difficult to demonstrate, except in the case of zenith pass for which Mesoamerica furnishes several good examples, but Egypt none.⁴

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4 For Mesoamerica, see A. F. Aveni, *Skywatchers of Ancient Mexico*² (Austin, 1990); for a hypothetical use of zenith passage in Egypt, see J. A. Belmonte, “Some open questions on the Egyptian calendar: an astronomer’s view”, *Trabajos de Egiptologia* 2 (2003), 7–56.
The controversial theories relying on simultaneous star transit to explain pyramid alignments for dating purposes exemplifies the problem. Part of the “Cosmology of Nut” system, present in the tomb of Ramesses IV and the Osireon of Abydos, and the Ramesside clock devices in the tombs of Ramesses VI, VII and IX probably also related to stars in positions far from the horizon.

Astronomy dealing with phenomena near the horizon includes heliacal risings (and settings) which are basic for the understanding of decanal star clocks. However, in what follows I shall concentrate on possible stellar or (luni)solar alignments on or near the horizon as a means of dating pharaonic monuments.

In Fig. III. 5.1 there are three problems, two of atmospheric origin (refraction and extinction), and one of a topographic nature (rough horizon). In the case of (luni)solar observations, the size of the solar disc presents a fourth problem. The azimuth of the rising or setting of a celestial object can be calculated in principle by using simple spherical trigonometry. Consequently, if a building were oriented with reference to a certain celestial body, it might be possible to calculate the date of the building’s foundation.

Simple spherical trigonometric calculations would apply only to a planet without atmosphere and with a flat surface. In reality, a celestial body is never seen rising or setting at . Figure 1 illustrates the following actual possibilities:

a’: The setting of the star, if only refraction is taken into account, e.g., at a flat desert horizon. This also varies because refraction is especially dependent on atmospheric conditions such as humidity, temperature,