figurations of stars on the celestial sphere. The proper motions of modern stars are known today with great exactness, so that it is possible to calculate their positions in the past and to compare these calculated coordinates with the corresponding coordinates shown for these stars in ancient star catalogues. This then permits a determination of approximate dates for the observations used in compiling the ancient catalogue and hence of the date of its compilation.

The geometrical-statistical method devised by the present authors has been tested on several star catalogues with well-known compilation dates as well as on several star catalogues generated artificially. In the case of artifical catalogues, the "date of observation" was, of course, known to the compilers but not to the investigators. This method of dating appears to be very accurate: all dates calculated by our method coincided with real (known) dates. The same method was then aplied to the Almagest star catalogue: the results obtained do not confirm the traditional dating of the Almagest and shift its dating to the Arabian epoch, i.e., 600–1300 A.D.

Our work (carried out in the period 1985–1989) is based on careful analysis of all geometrical, statistical, and calculation aspects of the problem. We do not touch on any historical problems; the work is purely geometrical and statistical. The method is based only on the analysis of numerical data contained in the star catalogues, namely, on the analysis of the coordinates of the stars.

2. Some Notions from Astronomy

We now formulate some standard notions (see [320, [321], and Figure 113) to explain the problem and our results. Suppose that the stars belong to the celestial sphere with its center being the "eye of the observer". To fix the position of the stars, we need a spherical coordinate system. Two such systems were customarily used in the Middle Ages: the equatorial system and the ecliptical one. The *equator* of the celestial sphere is the circle of the intersection of the sphere with the plane of the earth's equator. Parallels and meridians can then be introduced onto the sphere. The equatorial latitude δ is measured in arc degrees ($-90° \leqslant \delta \leqslant 90°$) and is called the *declination* of the star. The equatorial longitude α is measured in hours ($0 < \alpha \leqslant 24\text{hr}$) and is called the *ascent* of the star. The starting point for counting longitudes must be determined (see details below).

The intersection of the celestial sphere with the plane of the earth' orbit is called the *ecliptic*. The *zodiacal constellations* are distributed along the ecliptic. We can now define new latitudes and longitudes based on the ecliptic. The ecliptical latitude b is measured in arc degrees ($-90° \leqslant b \leqslant 90°$), and the ecliptical longitude l is also measured in arc degrees ($0 < l \leqslant 360°$). The position of the starting point for counting longitudes (the "zero meridian") must be fixed. The intersection of the equatorial plane with the ecliptical plane is the "axis of the equinox". This axis intersects the celestial sphere at two points, the spring equinox and the fall equinox. The point of the spring equinox is taken as the origin in the calculation of equatorial and ecliptical longitudes.

These two coordinate systems are not fixed, they evolve in time for the following reasons: