to the study of the sums of squares, “a study which led inevitably to the corpuscular or atomic theory of matter originally deriving from Lucretius and Epicurus” [Sh, p. 242].

Hariot connected sphere packings to Pascal’s triangle long before Pascal introduced the triangle. See Fig. 1.2.

Hariot was the first to distinguish between the fcc and hcp [Ma, p. 52].

Kepler became involved in sphere packings through his correspondence with Hariot in the early years of the 17th century. Despite Kepler’s initial reluctance to adopt an atomic theory, he was eventually swayed, and in 1611 he published an essay that explores the consequences of a theory of matter composed of small spherical particles. Kepler’s essay was the “first recorded step towards a mathematical theory of the genesis of inorganic or organic form” [W, p. v].

Kepler’s essay describes the fcc packing and asserts that “the packing will be the tightest possible, so that in no other arrangement could more pellets be stuffed into the same container.” This assertion has come to be known as the Kepler conjecture. The purpose of this collection of papers is to give a proof of this conjecture.

1.3. History

The next episode in the history of this problem is a debate between Isaac Newton and David Gregory. Newton and Gregory discussed the question of how many spheres of equal radius can be arranged to touch a given sphere. This is the three-dimensional analogue of the simple fact that in two dimensions six pennies, but no more, can be arranged to touch a central penny. This is the kissing-number problem in \( n \)-dimensions.