

appeared like models of the Solar System ; but disclosing unexpected objects, as the Ring of Saturn, and the Spots of the Sun. The art of observing made rapid advances, both by the use of the telescope, and by the sounder notions of the construction of instruments which Tycho introduced. Copernicus had laughed at Rheticus, when he was disturbed about single minutes ; and declared that if he could be sure to ten minutes of space, he should be as much delighted as Pythagoras was when he discovered the property of the right-angled triangle. But Kepler founded the revolution which he introduced on a quantity less than this. "Siuce," he says,^b "the Divine Goodness has given us in Tycho an observer so exact that this error of eight minutes is impossible, we must be thankful to God for this, and turn it to account. And these eight minutes, which we must not neglect, will, of themselves, enable us to reconstruct the whole of astronomy." In addition to other improvements, the art of numerical calculation made an inestimable advance by means of Napier's invention of Logarithms ; and the progress of other parts of pure mathematics was proportional to the calls which astronomy and physics made upon them.

The exactness which observation had attained enabled astronomers both to verify and improve the existing theories, and to study the yet unsystematized facts. The science was, therefore, forced along by a strong impulse on all sides, and its career assumed a new character. Up to this point, the history of European Astronomy was only the sequel of the history of Greek Astronomy ; for the heliocentric system, as we have seen, had had a place among the guesses, at least, of the inventive and acute intellects of the Greek philosophers. But the discovery of Kepler's Laws, accompanied, as from the first they were, with a conviction that the relations thus brought to light were the effects and exponents of physical causes, led rapidly and irresistibly to the Mechanical Science of the skies, and collaterally, to the Mechanical Science of the other parts of Nature : Sound, and Light, and Heat ; and Magnetism, and Electricity, and Chemistry. The history of these Sciences, thus treated, forms the sequel of the present work, and will be the subject of the succeeding volumes. And since, as I have said, our main object in this work is to deduce, from the history of science, the philosophy of scientific discovery, it may be regarded as fortunate for our purpose that the history, after this point, so far changes its aspect as to offer new materials for such speculations. The details of

^b *De Stellâ Martis*, c. 10.