Preface

In his treatise *On the Problem of the Historian*, Wilhelm von Humboldt states his views succinctly. "The problem of the historian is to tell what actually happened. The more exactly and completely he succeeds, the more perfectly he has solved that problem." In the three books of this series to date, I have tried to put Humboldt's precept into practice.

First, by publishing all of the letters and scientific papers dealing with Ceres and Pallas, the reader can examine exactly what was being thought and written by all the eminent astronomers of the time. Most of these letters have never been published before, and this is the first time they have ever appeared in English. Also, William Herschel's first two studies of Ceres and Pallas are given, along with an analysis of vicious contemporary critiques, one of which equated his work with evil.

Second, this book is deeply grounded in philosophy to establish the concepts and ideas that motivated the research and ideals of those astronomers. For example, in a study of the Paris Institute prize for a study of Pallas' orbit, I show why a mindset existed that led eminent scientists to think that all problems were solvable. Prizes offered by the academies of Paris and Berlin are surveyed to put the Pallas prize question in context. Other issues are related to such diverse philosophical discussions as Rene Descartes' *Optics;* John Locke's writing on language and ideas; Joseph Priestley's psychology of association; theories of reference to explore J.-J. Lalande's insistence on abjuring classical names for new planetary discoveries; gap theory by Adam Smith; David Hume's principle of resemblance; the concepts of anachronism, analogy and doubt; Thomas Young's analysis of hypothesis versus theory; Christian Wolff's deductive reasoning as applied to planetary distances; the theoretical and linguistic systems of Pierre Duhem; the intellectual antecedents of Laplace's concept of Intelligence in a deterministic cosmos; and the school of Scottish Common Sense Realism. The study of aesthetics by Francis Hutcheson, father of the Scottish Enlightenment, is used to relate the concepts of harmony and proportion that stretched from Pythagoras to Johannes Kepler to Capel Lofft. The relationships between Giuseppe Piazzi (discoverer of Ceres), the muse Urania, Apollo's lyre and the music of spheres are explored in part through a Latin poem

by Tycho Brahe. This book shows how Pallas wrote the final movement to the symphony of celestial harmony.

The 'geometric beam' perceived at the great Library in Alexandria by the Roman traveler Ammianus Marcellinus illuminates this story of Pallas. The geometrical structure of space is shown to be fundamental in understanding how the orbit of Pallas was determined and studied. This is examined through the work done by Carl Gauss and others on the perturbations Pallas is subjected to. As the nineteenth century Prussian military theorist Carl von Clausewitz observed: "Although our intellect always longs for clarity and certainty, our nature often finds uncertainty fascinating." Nowhere is this human fascination more evident than in the work on perturbation theory. Even the glittering allure of a gold prize from the Paris Academy was not sufficient incentive to fully solve the problem in an age that had no recourse to computational tools. All the literature dealing with the gold prize is presented in this book for the first time, as well as a unique solution to the Gauss anagram, a method Gauss used to ensure the priority of his remarkable orbital discovery about Pallas. His Latin treatise on Pallas is also published here for the first time in English.

The chance that there was an unobserved planet between Mars and Jupiter led Baron von Zach to organize a search for it in 1800. Chance of a different feather, in the form of probability theory, is another major element of this book as astronomers and mathematicians sought to elucidate the orbits and origin of the asteroids.

This book opens with the long-forgotten fact that the orbital elements of a planet between Mars and Jupiter were first printed in 1681. The missing planet idea that animated astronomers from Kepler to Zach is the perfect example of what the British historian of science A. Rupert Hall (1962a: 188) meant when he said, "The history of science derives its coherence less from the temporal succession of events than from the continuity of ideas." He went on to say that "while not neglecting the work of the scientist's hands the historian has to look more deeply for the thought that guided that work and gave it a theoretical structure." This book, thoroughly revised and updated from its first edition in 2004, examines both the thought and theoretical structure created by the astronomers and mathematicians in the early nineteenth century as they grappled with the existence of not just one missing planet but two.

Fort Lauderdale, FL, USA Clifford J. Cunningham

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