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978-0-521-55214-1 - *Fruitful Encounters: The Origin of the Solar System and of the Moon*
from Chamberlin to Apollo

Stephen G. Brush

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A history of modern planetary physics

Where did we come from? Before there was life there had to be something to live on – a planet, a solar system. During the past 200 years, astronomers and geologists have developed and tested several different theories about the origin of the Solar System and the nature of the Earth. Did the Earth and other planets form as a by-product of a natural process that formed the Sun? Did the Solar System come into being as the result of a catastrophic encounter of two stars? Together, the three volumes that make up *A History of Modern Planetary Physics* present a survey of these theories.

The early 20th century saw the replacement of the Nebular Hypothesis with the Chamberlin–Moulton theory that the Solar System resulted from the encounter of the Sun with a passing star. *Fruitful Encounters* follows the eventual refutation of the encounter theory in the 1930s and the subsequent revival of a modernized Nebular Hypothesis, which was reconstructed with the help of nuclear physics.

The “giant-impact” theory of the Moon’s origin imagines an actual collision between the young Earth and a Mars-size planet, with the Moon being formed from a mixture of material from the impacting planet and the Earth’s mantle. Professor Brush discusses the role of findings from the *Apollo* space program, especially the analysis of lunar samples, culminating in the establishment of this theory in the 1980s.

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Kinetic Theory, Volume 1, *The Nature of Gases and of Heat*; Volume 2, *Irreversible Processes*; Volume 3, *The Chapman–Enskog Solution of the Transport Equation for Moderately Dense Gases* (editor)

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A HISTORY OF MODERN PLANETARY PHYSICS

Fruitful encounters

*The origin of the Solar System and of the Moon from
Chamberlin to Apollo*

STEPHEN G. BRUSH

University of Maryland, College Park



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Preface

This is the third of three volumes presenting the results of my research on 19th- and 20th-century theories of the origin of the Solar System, the internal structure of the Earth, and the age of the Earth.

Nebulous Earth discusses theories of the origin of the Solar System – primarily the Nebular Hypothesis – in the 19th century, and follows ideas about the Earth’s core (including the geomagnetic dynamo) up to about 1970.

Transmuted Past outlines the attempts to estimate the age of the Earth in the 19th and 20th centuries, reviews related developments in nuclear physics and stellar evolution, and also offers perspectives on the changing reputation of planetary science, as well as on the comparison of styles in scientific and humanistic research.

Fruitful Encounters surveys the development of theories of the origin of the Solar System in the 20th century, including especially the impact of the *Apollo* lunar missions on ideas about the origin of the Moon.

Readers who are not already familiar with these subjects are advised to begin by reading the first chapter in each part, to get an overall view of the subjects discussed in that part.

This book has benefited greatly from the assistance and criticism of many historians and scientists, especially Michael A’Hearn, Edward Anders, Gustaf Arrhenius, James G. Baker, Alan Binder, Louis Brown, A. G. W. Cameron, Bibhas De, W. A. Fowler, Viktor Frenkel, Michael Gardner, Lawrence Grossman, Alan Harris, William K. Hartmann, Norriss Hetherington, William Kaula, Aleksey Levin, Alan Musgrave, John A. O’Keefe, Morris Podolak, R. T. Reynolds, A. E. Ringwood, Evgenia Ruskol, Christopher Russell, Victor Safronov, Susan Schultz, David Stern, David Stevenson, S. R. Taylor, William R. Ward, Paul H. Warren, Gerald Wasserburg, John Wasson, S. J. Weidenschilling, Don Wilhelms, John Wood, and M. M. Woolfson.

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PREFACE

Science Program of the National Science Foundation. This book was completed while I was a Member of the School of Social Science at the Institute for Advanced Study, Princeton, with financial support from the General Research Board of the University of Maryland and the Andrew W. Mellon Foundation.

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