

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

## CAMBRIDGE LIBRARY COLLECTION

*Books of enduring scholarly value*

### **Astronomy**

From ancient times, humans have tried to understand the workings of the world around them. The roots of modern physical science go back to the very earliest mechanical devices such as levers and rollers, the mixing of paints and dyes, and the importance of the heavenly bodies in early religious observance and navigation. The physical sciences as we know them today began to emerge as independent academic subjects during the early modern period, in the work of Newton and other 'natural philosophers', and numerous sub-disciplines developed during the centuries that followed. This part of the Cambridge Library Collection is devoted to landmark publications in this area which will be of interest to historians of science concerned with individual scientists, particular discoveries, and advances in scientific method, or with the establishment and development of scientific institutions around the world.

### **On the Determination of the Orbits of Comets**

When this book first appeared in 1793, there had been no significant work on comets published in English since Edmond Halley's death some fifty years before. In Europe the field was dominated by French astronomers such as Pingré and Laplace, but their ornate styles were often difficult to translate. In this concise monograph, Sir Henry Englefield (c.1752–1822) draws both on this continental work and on his own correspondence with William Herschel to produce one of the few accessible manuals in English for the computation of cometary orbits. He includes mathematical examples as new formulae are introduced, along with detailed tables and appendices. Englefield's particular interest was in the development of scientific instruments suitable for travellers – he devised a portable telescope and lent his name to the Englefield mountain barometer – and his passion for efficiency shines through in this work, still valuable to researchers in the history of astronomy and comet science.

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---

Cambridge University Press has long been a pioneer in the reissuing of out-of-print titles from its own backlist, producing digital reprints of books that are still sought after by scholars and students but could not be reprinted economically using traditional technology. The Cambridge Library Collection extends this activity to a wider range of books which are still of importance to researchers and professionals, either for the source material they contain, or as landmarks in the history of their academic discipline.

Drawing from the world-renowned collections in the Cambridge University Library and other partner libraries, and guided by the advice of experts in each subject area, Cambridge University Press is using state-of-the-art scanning machines in its own Printing House to capture the content of each book selected for inclusion. The files are processed to give a consistently clear, crisp image, and the books finished to the high quality standard for which the Press is recognised around the world. The latest print-on-demand technology ensures that the books will remain available indefinitely, and that orders for single or multiple copies can quickly be supplied.

The Cambridge Library Collection brings back to life books of enduring scholarly value (including out-of-copyright works originally issued by other publishers) across a wide range of disciplines in the humanities and social sciences and in science and technology.

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---

# On the Determination of the Orbits of Comets

*According to the Methods  
of Father Boscovich and Mr de la Place*

HENRY ENGLEFIELD



**CAMBRIDGE**  
UNIVERSITY PRESS

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father  
Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---

CAMBRIDGE UNIVERSITY PRESS

Cambridge, New York, Melbourne, Madrid, Cape Town,  
Singapore, São Paulo, Delhi, Mexico City

Published in the United States of America by Cambridge University Press, New York

[www.cambridge.org](http://www.cambridge.org)

Information on this title: [www.cambridge.org/9781108061735](http://www.cambridge.org/9781108061735)

© in this compilation Cambridge University Press 2013

This edition first published 1793

This digitally printed version 2013

ISBN 978-1-108-06173-5 Paperback

This book reproduces the text of the original edition. The content and language reflect  
the beliefs, practices and terminology of their time, and have not been updated.

Cambridge University Press wishes to make clear that the book, unless originally published  
by Cambridge, is not being republished by, in association or collaboration with, or  
with the endorsement or approval of, the original publisher or its successors in title.

Cambridge University Press  
978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father  
Boscovich and Mr de la Place  
Henry Englefield  
Frontmatter  
[More information](#)

ON THE  
DETERMINATION  
OF THE  
ORBITS OF COMETS,  
ACCORDING TO THE METHODS OF  
FATHER BOSCOVICH AND MR. DE LA PLACE.  
WITH  
NEW AND COMPLETE  
TABLES;

AND EXAMPLES OF THE CALCULATION BY BOTH METHODS.

BY SIR HENRY ENGLEFIELD, BART.  
F. R. S. & F. A. S.

NOS QUOQUE SUB DUCIBUS CÆLUM METABIMUR ILLIS.

LONDON:  
PRINTED BY RITCHIE AND SAMMELLS,  
FOR PETER ELMSLY, IN THE STRAND.

MDCXC111.

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father  
Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father  
Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---

T O

THE RIGHT HONOURABLE

JAMES STUART MACKENZIE:

AS A MARK OF SINCERE ATTACHMENT,

AND RESPECTFUL GRATITUDE

FOR FRIENDSHIP

CONTINUED FROM HIS FATHER TO HIMSELF,

THIS WORK

IS INSCRIBED,

BY HIS FAITHFUL AND AFFECTIONATE

HENRY C. ENGLEFIELD.

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father  
Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---



Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

## P R E F A C E.

THE Theory of Comets, discovered and demonstrated by Newton, has not only been the basis of all subsequent researches in that curious and difficult branch of Astronomy; but in its great principles and essential parts, was brought to absolute perfection by its illustrious Author. Having proved that Comets, passing through the regions of space in all directions, and traversing the whole solar system, do many of them approach much nearer to the Sun than any of the Planets; he attempted the investigation of the real path of a Comet, from its places observed on the Earth. This Problem, which even he calls, *Longè difficillimum*, he completely solved; and demonstrated that Comets move round the Sun in orbits extremely excentric, but obeying the same laws which guide the Planets of the Solar System.

Dr. Halley, whose assiduous labours in every branch of Astronomy during a life protracted to a more than usual extent, will ever be subjects of admiration; notwithstanding the immense length and labour of the Newtonian process, applied it to twenty-four Comets, every one of which afforded an additional

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

vi.

## P R E F A C E.

and complete confirmation of the truth of Newton's Theory, and the accuracy of his method.

But though the precision of this method left nothing to be desired on that head; yet its extreme length and difficulty induced subsequent Mathematicians to seek for modes of shortening and simplifying this laborious process. Almost every Academy has proposed some branch of the Theory of Comets as a subject for their Prize dissertations; and the genius of almost every eminent Geometer on the Continent, has at different times been exercised on this curious and interesting subject.

This country has however unaccountably neglected the Astronomy of Comets, and since the decease of Dr. Halley, nothing has been published on this subject worthy of mention, except the excellent little treatise of Mr. Barker, printed in the year 1757:\* while in Italy, Father Boscovich; in Germany, Lambert and Tempelhoff; in Holland, Struyk; in France, among many others, Clairaut, Du Séjour, De la Grange, and De la Place; in Russia, the great Euler, and Lexell; have at differ-

\* This work, entitled "An Account of the Discoveries concerning Comets," contains not only a very accurate and practical account of the Newtonian Method of Computation; but a Table of the Parabola, which in extent, accuracy and convenience, is equal to any extant; and till the publication of Mr. Pingrè's great table of the Parabola in his Cométographie, was far superior to any in use: yet this excellent book was so totally unknown on the Continent, that neither Mr. Mechain nor Mr. Pingrè had ever heard of it till it was made known to them by me. Mr. Mechain in a letter to me speaks in the highest terms of the Table of the Parabola.

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

## P R E F A C E.

vii.

ent times contributed largely to clear the roads or extend the limits of knowledge on this subject.

Their writings however, forming part of voluminous Academic Collections, were accessible to few; or printed in small tracts were in danger of being entirely lost; till Mr. Pingrè collected these scattered Rays into one Focus in his great Work, called *Cometographie*; in which his abilities as an Historian, and Geometer, his deep Research, and critical Skill, are equally apparent. Yet this excellent Work from its size necessarily expensive, and written in a foreign language, cannot be so generally known in this country as it deserves; and we are yet without a book in our own tongue, which in a moderate compass may make us acquainted with the modern methods of Cometary Calculation, most generally used and approved, by those who have peculiarly applied themselves to this branch of Astronomy.

This deficiency the following Pages are intended in some measure to supply; not by giving to the Public a complete Translation of the Mathematical part of Mr. Pingrè's work, a task far above my abilities, and which would certainly be too expensive to answer my purpose; but by a full detail of the two methods which I have tried with success; that of Father Boscovich for a first approximation to the Elements, which will almost always enable the Computer, after a few days observations of a Comet, to predict its motion so as to find it after an interval of bad weather, or Moonlight, or proximity to the Sun\*;

\* As a proof of the degree of Accuracy generally attainable by the Method of Father Boscovich, the following Comparison is given of the Approximate Elements of two late Comets, as determined by me after

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

viii.

P R E F A C E.

and that of Mr. De la Place, both for a first Approximation, and the final determination of Elements as exact as the Observations themselves will allow.

Although however I have said that both these Methods are given in the Cometographie of Mr. Pingrè, yet it is not from that Book, but from the originals of the Authors that the present work has been compiled. The Method of Father Boscovich which he first published in two most elegant Latin Differ-

a very few days Observations; with the correct Elements computed by Mr. Mechain, from the whole of the Observations on those Comets.

	ENGLEFIELD.				MECHAIN.				
	1790.								
	S	°	'	"	S	°	'	"	
Longitude of Ascending Node	1	5	14	0	1	3	11	2	
Inclination of the Orbit		63	35	0		63	52	27	
Place of Perihelion on Orbit	9	4	57	20	9	3	43	27	
Logarithm of Perihelion Dist.	9.8981795				9.9019814				
	0.791005				0.797960				
Time of arrival at Perihelion	D	H	M	S	D	H	M	S	
May . . . . .	20	11	21	0	21	5	47	0	
Motion Retrograde.									
	1792.								
	S	°	'	"	S	°	'	"	
Longitude of Ascending Node	6	11	55	0	6	10	46	15	
Inclination of the Orbit		41	5	0		39	46	55	
Place of Perihelion on Orbit	1	4	43	0	1	6	29	42	
Logarithm of Perihelion Dist.	0.1111953				0.1116064				
	1.2918				1.29301				
Time of arrival at Perihelion	D	H	M	S	D	H	M	S	
January . . . . .	15	6	0	0	13	13	35	0	
Motion Retrograde.									

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

## P R E F A C E.

ix.

tations inserted in the 7th Volume of the *Memoires des Scävans Etrangers*, is very concisely given, from those papers, in Mr. Pingrè's work; so concisely indeed, as hardly to do justice to the method as there given by the Author; but since the impression of that part of the *Cometographie*, the learned Author made several improvements in his method, and published the whole in a very long treatise, which makes a part of a work in five Quarto Volumes, intitled *Opuscula*; printed at Bassano in the year 1785, but a short time before his death: this treatise is written in very indifferent French, full of repetition and superfluous detail; in which the essential parts of the Method are so buried, as not to be followed without much pains and difficulty. It therefore became necessary not to translate, but to extract and recompose many parts of it; and I am yet afraid that I have not been able wholly to correct the defects of the Original. I hope however that I have not added any mistakes of my own. Some observations which occurred in the course of the many trials made of the Method, I have ventured to give in the form of notes; and in order to render a reference to the Original, easy to any person who may be inclined to compare this work with it; to each paragraph is added the number of that section to which it corresponds in the French text.

The learned and valuable Method of Mr. De la Place is given by him in a Memoir in the Volume of the *Memoires de l'Academie des Sciences*, for the Year 1780; and consists of two parts; the first contains the Principles on which his method is founded; the second, the practical part of it.

This work only contains the Second part of Mr. De la Place's Memoir, in translating which, I have not exactly followed his

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

x.

## P R E F A C E.

Text; but have combined it with Mr. Pingrè's account of it, and inserted many very useful Observations and Explanations, which I owe to the friendship of Mr. Mechain. An example of the whole process, in both the Methods of Cometary Calculation, has been added; with every part of the Computation at full length; such examples being of much use in giving a distinct idea of the rules. To the rule however for finding the Comet's Geocentric place from the Elements given, no example is given; the process being very simple, and to be found in every book which treats on the subject.

The Tables which are added, are all which can be wanted in this part of Cometary Calculation: and are the most extensive and accurate extant. Full instructions for their use, with complete examples, are given.

It was at first intended to have given an history of the principal Comets observed since the discovery of Telescopes, particularly with regard to the Phœnomena of their Nuclei and Tails; but the work has by degrees increased to such a size, that any further addition to it would have rendered it more expensive than was wished, as the principal aim was to make it of general use. Should however the public at all encourage the further prosecution of the subject, much curious and singular detail is collected both from scarce books and Manuscripts, which may at some future time be communicated, as a second part of this work.

Some alterations and improvements which occurred since the former sheets of the work were printed off, are given at the end of the book as an appendix. The Table of Abcissæ and Ordinates, which may sometimes be very convenient for drawing

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---

P R E F A C E.

xī.

Parabolas, and which, as far as I know, has never been given ; is added to the other Tables. Its uses are explained in the Appendix.

Every endeavour has been used to render the impression of this work, as correct as possible : some errors it is however scarcely possible to avoid. The Table of Errata is the result of repeated examinations of the book ; and it is hoped that no error is left undetected.

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father  
Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

---



## C O N T E N T S.

	PAGE.
CHAPTER I.	
<i>GENERAL View of the Method.</i>	
CHAPTER II.	
<i>On the Motion of the Point of Intersection of the Radius Vector and Cord.</i>	8
CHAPTER III.	
<i>On the Comparison of the Parabolic Cord with the Space which answers to the mean Velocity of the Earth in the same time.</i>	16
CHAPTER IV.	
<i>Of the Reduction of the Second Longitude of the Comet as observed in the Arches of the Orbits of the Earth and Comet, to that, which would have been observed in their Cords.</i>	19
CHAPTER V.	
<i>On the Proportion of the three Curtate Distances of the Comet from the Earth.</i>	26

ii.	C O N T E N T S.		
	C H A P T E R VI.	PAGE.	
	<i>Of the Graphical Declination of the Orbit of the Earth, and the Parabola of a Comet; and their division into months and days.</i>	—	29
	C H A P T E R VII.		
	<i>Of the Numerical Quantities to be prepared for the Construction or Computation of the Comet's Orbit.</i>		36
	C H A P T E R VIII.		
	<i>Determination of the Distances of the Comet from the Earth and Sun by the Graphical Method.</i>		40
	C H A P T E R IX.		
	<i>Determination of the Elements of the Orbit from the determined Distances.</i>	—	51
	C H A P T E R X.		
	<i>Determination of the Place of the Comet for any given time.</i>	— —	60
	C H A P T E R XI.		
	<i>Determination of the Distances of the Comet from the Earth and Sun, by Trigonometrical Calculation.</i>		64
	C H A P T E R XII.		
	<i>Determination of the Comet's Orbit, by Trigonometrical Calculation.</i>	—	68

Cambridge University Press

978-1-108-06173-5 - On the Determination of the Orbits of Comets: According to the Methods of Father Boscovich and Mr de la Place

Henry Englefield

Frontmatter

[More information](#)

C O N T E N T S.		iii.
		PAGE.
C H A P T E R   X I I I .		
<i>Determination of the Place of the Comet, for any other given Time, by Calculation.</i>	—	73
C H A P T E R   X I V .		
<i>Application of the Graphical Method to the Comet of 1769. And first, on the Determination of the Curtate Distances from the Earth, and the two Radii and Cord.</i>	—	76
C H A P T E R   X V .		
<i>Application of the Distances found, to the Determination of the Elements of the Comet of 1769 by Construction.</i>	—	85
C H A P T E R   X V I .		
<i>Determination of the Place of the Comet, for another given Time.</i>	—	90
C H A P T E R   X V I I .		
<i>Application of the Trigonometrical Method to the Comet of 1769. And first, for the Determination of the two Curtate Distances from the Earth, and the Radii Vectores and Cord.</i>	—	94
C H A P T E R   X V I I I .		
<i>Determination of the Elements of the Orbit of the Comet of 1769, by the Trigonometrical Method.</i>		99

iv. CONTENTS.		PAGE.
<i>Example of the Graphical Operation for the Orbit of the Comet of 1769.</i>	—	103
<i>Example of the Trigonometrical Operation for the Orbit of the Comet of 1769.</i>	—	111
<i>Conclusion.</i>	— —	125
<i>General Method for determining the Orbits of Comets: by Mr. De la Place. PART I. Determination of the Approximate Perihelion Distance, and Time of the Comet's Arrival at the Perihelion.</i>	—	133
<i>PART II. Determination of the two Elements of the Orbit, from the Approximate Perihelion Distance, and Time of Arrival at the Perihelion, before found.</i>	— —	144
<i>Application of Mr. De la Place's Method of finding the Approximate Perihelion Distance, and Time of Arrival at the Perihelion; to the Comet of 1769.</i>		154
<i>Application of Mr. De la Place's Method for correcting the Orbit of a Comet, to the Comet of 1769.</i>		177
<i>Explanation and Use of the Tables.</i>	—	193
<i>Tables.</i>	— —	205