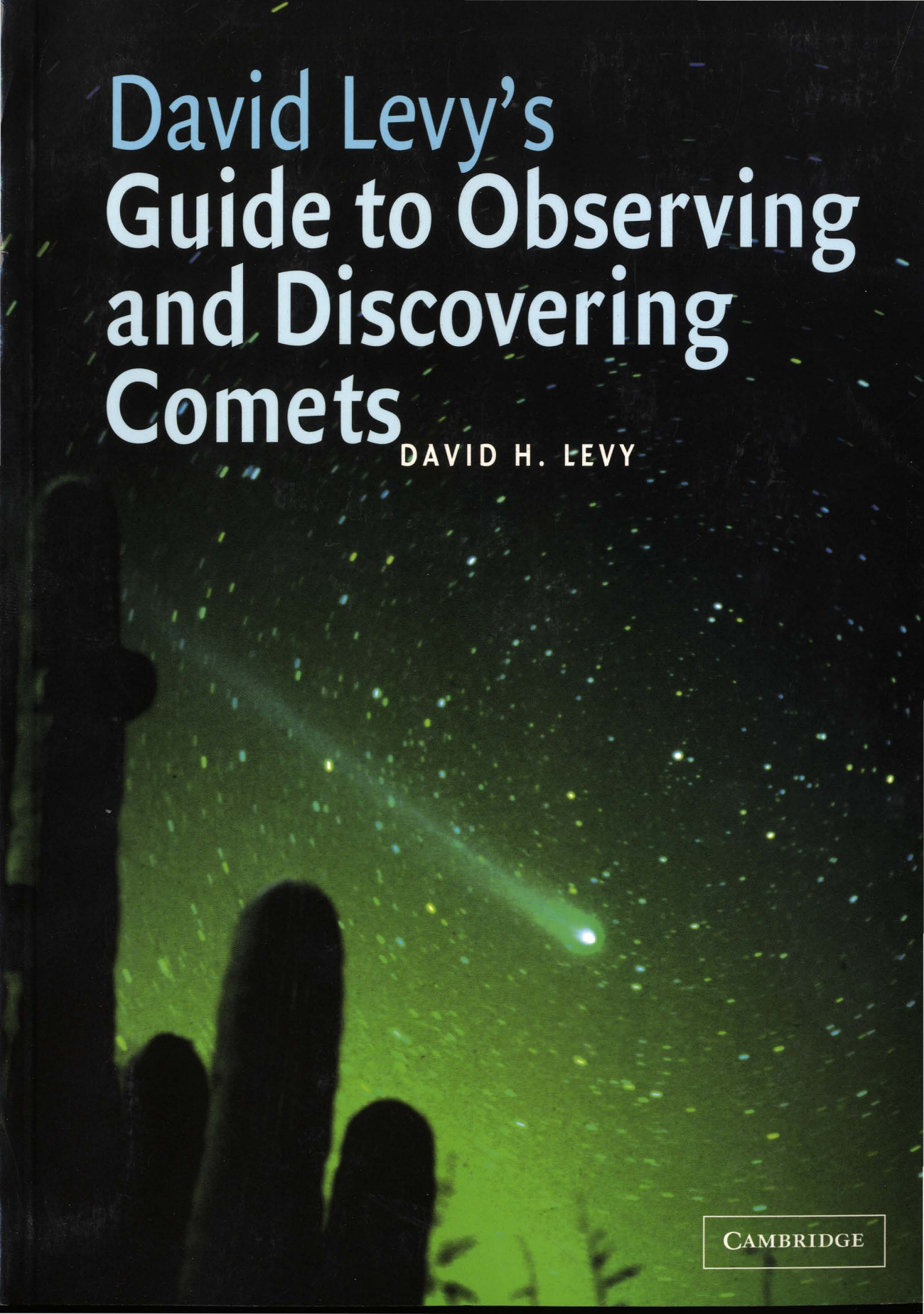
David Levy's Guide to Observing and Discovering Comets

DAVID H. LEVY



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David Levy's Guide to Observing and Discovering Comets

David Levy has held a lifelong passion for comets, and is one of the most successful comet discoverers in history. In this book he describes the observing techniques that have been developed over the years – from visual observations and searching, to photography, to electronic charge-coupled devices (CCDs). He combines a history of comet hunting with accounts of the latest techniques, showing how our understanding of comets has evolved over time. The book is suitable as a practical handbook for amateur astronomers, from those who are casually interested in comets and how to observe them, to those who want to begin and expand an observing program of their own. David Levy draws widely from his own experiences of a lifetime of observing comets, describing how enthusiastic amateurs can observe comets and try to make new discoveries themselves.

David Levy has discovered 21 comets, eight of them using his own backyard telescopes. In collaboration with Eugene and Carolyn Shoemaker, he discovered Shoemaker–Levy 9, the comet that collided with Jupiter in 1994, producing one of the most spectacular explosions ever witnessed in the solar system. He is a contributing editor for *Sky & Telescope* magazine, Science Editor for *Parade* magazine, and is the author or editor of twenty-nine books. He won an Emmy in 1998 as part of the writing team for the Discovery Channel documentary, *Three Minutes to Impact*. He is currently involved with the Shoemaker–Levy Double Cometograph comet search program, based at the Jarnac Observatory in Arizona.

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To Wendee, my wife, I love you –
and to our grandchildren
Summer and Matthew
May your comets always be bright
and beautiful

Contents

Acknowledgments

When Simon Mitton of Cambridge University Press suggested that I write a guide to observing and discovering comets based on my personal experience, I was immediately interested in the idea. It is not that I needed to write a book on comets (this one is my sixth), but the possibility of writing something based on the passion I have had for so long was tremendously exciting. Thank you Simon, for this good suggestion. Thanks also to Wendee, my wife, who immediately encouraged me to follow Simon's suggestion, and who has been extremely helpful throughout this book's formative process. Wendee also prepared the index.

Dean Koenig and Scott Tucker of Starizona, amateur astronomer Tim Hunter, Daniel Green of the Central Bureau for Astronomical Telegrams, and Joan-ellen Rosenthal have been helpful with suggestions. Finally, Bill Buckmaster of KUAT television has been very supportive throughout.

Introduction: a personal odyssey with comets

Comets are like cats; they have tails, and they do precisely what they want.

David H. Levy, 1996.[1]

Time has not lessened the age-old allure of the comets. In some ways their mystery has only deepened with the years. At each return a comet brings with it the questions which were asked when it was here before, and as it rounds the Sun and backs away toward the long, slow night of its aphelion, it leaves behind with us those questions, still unanswered.

To hunt a speck of moving haze may seem a strange pursuit, but even though we fail the search is still rewarding, for in no better way can we come face to face, night after night, with such a wealth of riches as old Croesus never dreamed of.

Leslie C. Peltier, 1965.[2]

How many of us have looked up at the sky, and marveled at its supposed permanence? The sky on a clear night is one of the most reliable aspects of our lives; at a certain time on a particular date, we *know* that the stars will form their special patterns. This is almost true: Occasionally a comet will appear, interrupting this cosmic serenity and reminding us that even the heavens offer surprises, even the heavens are not immutable.

This book is designed to give its readers a sense of how people go about discovering and observing comets. The approach it follows combines a history of the field with the latest techniques for finding and observing comets. You can dip into the book at any part or chapter you like, but if you read the chapters as written, you will follow a natural progression of how our understanding of comets has evolved over time.

This is my sixth book about comets, a subject that continues to play a vital role in my own life.[3] That interest can be traced back to an airplane vapor trail

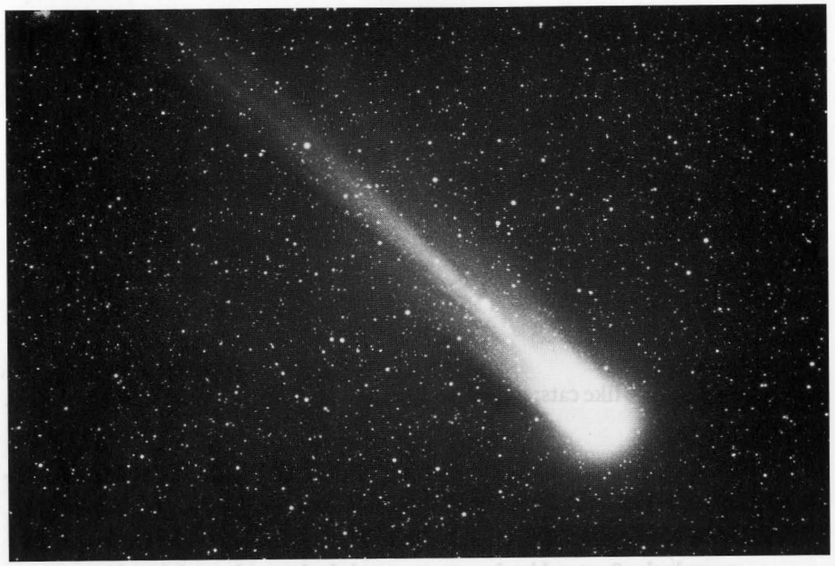

Figure I.1. On March 23/24, 1996, Canadian amateur astronomer Leo Enright took this photograph of Comet Hyakutake (C/1996 B2) at Sharbot Lake, Ontario, using a Canon 135 mm at f/2.5, with Kodak Ektachrome 1600 Professional film. Gamma Bootis is the brightest star inside the comet's tail. Courtesy Leo Enright.

on a sunny afternoon at the Hebrew school in Montreal. We kids were sitting around and chatting, waiting for our teacher to arrive, when I saw what looked like a comet with a bright trail hanging in the western sky. Since it did not appear to move, I thought it could not be an airplane. Could it be a comet, I recall thinking, and could it even be that I had discovered a comet? For a few minutes I was pretty excited, but then Mr. Mushkin arrived, our class began, and I forgot about the great Levy comet of 1959. I guess it was not a comet, for something bright enough to be seen in daylight would have surely made the annals of observing history. It might have been a plane moving directly toward or away from me. Frankly, to this day I am unsure what it really was.

Several months later, in elementary school, our sixth-grade teacher assigned each of us to give a 3-minute lecture in class. Terrified to talk in front of an audience, and especially in front of our strict teacher Mr. Powter, I spent many hours thinking not about a choice of topic but about how I could try to present a speech without actually having to face my sixth-grade peers. When speech day came, however, I was prepared. I presented a verbal tome on comets, but I used no notes. I had memorized everything I wanted to say, but in order not to have to face the audience, I carried with me a blank sheet of paper. Since my source

was Leon Housman and Jack Coggins's *The Big Book of Stars*, a children's book I still have,[4] I can recall what I said that faroff day. Comets, I intoned, consist of a nucleus, a coma, and a tail – all still correct, although the 100+ mile diameter I quoted for a typical comet nucleus was off by a factor of ten. I mentioned Halley's comet, then on its way for a future rendezvous with Earth – its 1986 visit seemed a very long time in the future back then.

I also remember saying – possibly in reference to my own observation from a year earlier – that it was possible to discover comets, and that some people spend many years searching through small telescopes in the hope that they might, some day, find a new comet. Still holding my blank sheet of paper, I was tremendously relieved when the presentation was over. After the class applauded politely, Mr. Powter said, "Great speech, Levy. Can I see your notes?" The children in the front row, who easily saw my blank paper ploy, broke out in laughter.

That was March, 1960. By the end of that summer I was a stargazer committed to spending the next several years learning as much as I could about all aspects of astronomy. Comets were a part of those frenetic early years in astronomy, but my specific interest in them did not really return until October 1965, when I read about the discovery of a comet by two Japanese amateur astronomers, Kaoru Ikeya and Tsutomu Seki. The comet was a sungrazer, headed straight toward a rendezvous with the Sun during which it would complete a hairpin turn some 300000 kilometers from the Sun's photosphere.

The anticipation of seeing this wondrous comet really ignited my passion for comet hunting. That fall, while walking to an early French oral examination in tenth grade, and knowing that one of the questions would pertain to my choice of hobby, I decided to respond "Je veux découvrir une comete." It felt like the right thing to do at the time, and I especially enjoyed planning a search strategy. I knew that the best place for a visual, amateur search would be in the evening, after dark in the west, or in the morning, before dawn in the east; comets tend to be brighter when they are close to the Sun. However, since clouds often block the Montreal sky, my early searching took place whenever I could find a clear night. It was 19 years before I found my first new comet in 1984. Since then I have found, independently or with others, 20 other new comets.

Nothing in all those early years could have prepared me for what happened in the momentous spring of 1993. Observing with Gene and Carolyn Shoemaker, I took two photographs that recorded the motion of Comet Shoemaker–Levy 9 just a few months after an encounter with the tidal force of Jupiter that tore the comet into a string of fragments. This completely

disrupted object looked like a squashed comet, as Carolyn described it, but through larger telescopes it resembled a string of pearls as its 21 pieces moved through the sky. On May 22, 1993, the International Astronomical Union announced that the comet, named Shoemaker–Levy 9, would collide with Jupiter in July 1994. Humanity learned from the catastrophic impact that followed, for as Comet Shoemaker–Levy 9 struck Jupiter, it provided an important lesson in our heritage: The impact recalled a solar system that had a violent youth, with comets plummeting into planets, bringing with them the elements of organic materials – carbon, hydrogen, oxygen, and nitrogen. On at least one of those planets, life arose from those chemicals.

A childhood whim and a grade-school assignment later developed into my lifelong passion for comets. In this book, I share the observing techniques that have been developed over the years by people who have enjoyed watching comets as much as I have. These techniques span the gamut from visual observations and searching, to photography, to electronic charge-coupled devices (CCDs). For visual observing, I decided years ago that if I planned to discover a comet, I should know what comets look like by observing as many known comets as possible. In 1985, I leaped from visual to CCD observing by joining the Near-Nucleus Studies Net of the International Halley Watch. As part of that effort, Steve Larson and I used a CCD to build a nightly record of the apparition of Halley's comet from late 1985 until 1989, and in the course of that survey recorded many other comets as well.

My work with conventional photography of comets began in 1970, when I photographed Comet Bennett. In 1988 I added photography to my search and observation program, and a few months later joined Gene and Carolyn Shoemaker's photographic search program. Over their careers together, the Shoemakers exposed more than 26000 films. Being a part of that effort gave me a sense of what photography can accomplish while observing comets and searching for them. Now my wife Wendee and I, along with Carolyn Shoemaker, are part of a group called the Jarnac Comet Survey. We are searching in all three ways – visually, photographically, and with CCDs, and we try to record the known comets as they make their way through the sky. Just as I did in sixth grade, I still think that writing about a subject is a great way to learn about it. Through writing this book I hope that our group will be able to refine and improve its observations. At the same time, I hope that you, as a reader, will get an idea of what comet observation is all about. Whether you are just casually interested in comets and how you observe them, or if you want to begin or expand an observing program of your own, I hope that this book will give you a sense of the passion that we comet observers have.

NOTES

1. *The Today Show*, NBC Television, March 23, 1996.
2. Leslie C. Peltier, *Starlight Nights: The Adventures of a Star-Gazer* (New York: Harper & Row, 1965), 231.
3. The first five books are:

   Observe: Comets, with S. J. Edberg. (Astronomical League, 1985).
   An Observing Guide for Comets, Asteroids, Meteors, and Zodiacal Light, with Steve Edberg. Revised and expanded edition of *Observe: Comets* (Cambridge: Cambridge University Press, 1994).
   The Quest for Comets: An Explosive Trail of Beauty and Danger (New York: Plenum, 1994. Paperback editions from New York: Avon Books, 1995, and Oxford: Oxford University Press, 1995).
   Impact Jupiter: The Crash of Comet Shoemaker–Levy 9 (New York: Plenum, 1995).
   Comets: Creators and Destroyers (New York: Simon & Schuster, 1998).

   There is also a slide set:

   Comet Shoemaker–Levy 9 Slide Set, with the editors of *Sky & Telescope* (Cambridge, MA: Sky Publishing, 1994).
4. Leon A. Housman and Jack Coggins, *The Big Book of Stars* (New York: Grosset & Dunlap, 1955).