Preface

Traditionally, comet observing/hunting and variable star observing have been widely considered the two fields of amateur astronomy where the visual observer is capable of making a true contribution to scientific knowledge. That is not to say that contributions cannot be made in other fields as well, but these two subjects were widely regarded as offering the most opportunities for users of modest equipment and were accordingly very popular with amateur astronomers.

Comets, in particular, presented some very attractive prospects. As well as being interesting objects in their own right, they had for many years been largely neglected by the professional astronomical community, and the brighter ones at least can be studied with minimal equipment.

Then, of course, there was the prospect of actually discovering a new object and the very rewarding consequence that comets were traditionally named for their discoverers. The possibility of having one's name attached to an astronomical object to be cataloged for all time was certainly an incentive to spend many hours sweeping the sky in search of these bodies! Even naked-eye discoveries, while not common, were not unknown, and large binoculars or small telescopes using low-power eyepieces were the preferred instruments of most successful comet hunters. A newspaper report of the discovery of Comet Ikeya in 1963 went so far as to describe the instrument used by (the then 19-year-old) Kaoru Ikeya as a "toy," although the journalist did at least have the courtesy to place that word in quotes. The telescope was no toy—it was a well-made 8″ (20-cm) reflector—but it had been constructed by the discoverer himself at minimal cost.

With the increasing number of professional programs employing wide-angle cameras, from the middle years of the last century, the percentage of amateur discoveries declined as objects too faint for visual detection were accidentally picked up by these programs, not that the discovery of comets was their aim. Most of the programs were set up

to find minor planets or nearby stars through their large proper motion, but the extra comet discoveries still provided a welcome bonus. Around the same time, there was somewhat of revival of interest in comets among professional astronomers as the role of these objects in Solar System formation and even in terrestrial life (through the possible delivery of water and organic compounds) began to be recognized.

On the whole, however, this did not have too great an effect on amateur discoveries. Many of the comets found during the course of professional programs remained faint and would not have been discovered visually by amateurs. A visual search program by professional astronomers at the Skalnate Pleso Observatory in Czechoslovakia (now Slovakia) from the late 1940s until about 1960 proved more troublesome, as it was in direct competition with amateurs at that time; however, the number of amateur discoveries (especially by the Japanese) increased again during the 1960s following the termination of the Czechoslovakian program.

From about 1960 until the middle of the decade of the 1990s, visual discoveries by amateur astronomers were frequent. The popularity of Dobsonian telescopes made larger aperture reflectors more readily and cheaply available, and high-power binoculars having apertures of 80 mm and larger became easier to acquire. At the same time, increased interest by professional astronomers made amateur observations more in demand, and publications such as the *International Comet Quarterly* provided repositories for comet observations as well as recent professional research concerning these objects. This period became something of a golden age for visual comet observing.

All this changed in about the middle of the 1990s. A combination of automated professional programs in search of potentially hazardous near-Earth asteroids plus space-based surveys of various kinds has proved to be far more efficient at comet discovering than the photographic programs of earlier decades. These recent programs have largely been responsible for the discovery of comets many months or even years before these objects reach perihelion.

Although inevitably faint at the time of discovery, many of the comets found in this way have later brightened to within the visual range of small telescopes and would very likely have been visual discoveries had the automated programs not been operating. On the other hand, the most successful of the nonhuman comet discoverers—the SOHO

extraterrestrial solar observatory—has robbed visual observers of few objects, most of these potentially visual finds having been spotted on ultraviolet images secured by the SWAN instrument. Two of the SOHO coronagraphs, LASCO 2 and 3, have found over 3000 comets at latest count (more than the total of all known comets prior to 1995!), but just three of these were sighted from the ground, and only two of these would have stood any chance of visual discovery.

In recent years, as we look through the list of new comet discoveries, we are met with names such as LINEAR, PANSTARRS, LEONOS, Siding Spring, Catalina, MOSS, ISON, SOHO, NEOWISE, and so forth. These are obviously not the names of people. They are either the acronyms of automated programs or the observatories (some space-based) from which the discoveries were made. One may look at the list and be discouraged, not just from visual comet searching but also from visually observing comets at all.

This book has been written to hopefully counter this feeling. Although it would be fanciful to think that anyone armed with nothing more than a good pair of binoculars still has as strong a chance of discovering a comet as he or she had 30 years ago, it is equally incorrect to think that a dedicated visual comet hunter no longer has any prospect of success. Moreover, it would be *very* wrong to think that comet observing with the eye instead of a CCD no longer has an important place in astronomy. As the following pages will hopefully make clear, visual observations are needed as much as they ever were.

This book is divided into three main sections. In the first of these, we take an overview of the subject, briefly covering the changing views of comets from earliest times down to the present day. We examine the main features of these objects and the reason why they display their characteristic activity while relatively close to the Sun.

Part Two deals specifically with the types of observations by which visual observers can make meaningful contributions to the study of comets. In the course of this section, we will look at the best approach to comet hunting in this age of automated programs and the types of comets that are more likely to be discoverable by visual means as well as the regions of the sky where they are more likely to be found.

As well as comet hunting, we shall look at the various types of observations that can best be undertaken by the amateur astronomer with relatively simple visual equipment.

The most important observations are those determining the total magnitude of the comet's head or coma. The various methods of estimating this value, together with the benefits and difficulties peculiar to each, are examined. The methods of estimating the diameter of the cometary coma are also discussed, together with a scale for the degree of central condensation of the coma. A chart depicting the appearance of cometary comae showing the varying degrees of condensation is provided to enable direct comparison with the image seen in the eyepiece. These measurements of diameter and estimates of degree of condensation provide an idea of how the comet appears in the eyepiece of a telescope. We will also discuss what to look for concerning the tails of comets and how the length and orientation of these features, with respect to the head, can be measured.

In addition to these quite basic observations, various unusual and at times controversial features that have been reported from time to time are mentioned. These range from the well-established coma and tail structures such as jets and envelopes in the coma, rays and striae in the tail, secondary condensations, and "satellite" comets to controversial reports such as aurora-like fluctuations and pulsations in tail brightness occurring over very brief time intervals in addition to rapid apparent motions along the tail.

Verbal descriptions of the different features are supplemented by photographs of actual examples displayed by relatively recent comets in addition to several drawings made by observers of objects seen in earlier years. These should help observers identify similar cometary phenomena observed by the naked eye or through the eyepiece of a telescope.

Part Three of this book then turns to several of the brighter and/or more interesting periodic comets predicted to appear between the end of 2016 and 2027. A brief observational history of each of the listed comets is given, together with the orbital elements for the predicted return, an ephemeris covering the period of maximum expected brightness of each comet and a chart depicting the path that the comet is predicted to follow across the sky. This information should be sufficient for observers to use in their determination of more exact ephemerides adapted to their location and time of observation. Updated orbital elements will almost certainly be available on the Web as the time of return of these comets approaches, especially following their first detection through large telescopes and while they are still distant

from the Sun, and these upgrades will enable even more accurate predictions to be made in due time. Of course, it must always be remembered that comets are notoriously unpredictable, and this should especially be borne in mind with respect to the magnitude forecasts provided here. These are only approximations at best and may turn out to be wide of the mark.

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