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Charles Olivier and the Rise of Meteor Science

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This book is dedicated with love to my wife
Margaret whose encouragement during
the long process of writing this book has been
much appreciated

Preface

Charles Olivier and the Rise of Meteor Science was to be a centennial history of the American Meteor Society (AMS), from 1911 to 2011. However, when I investigated the AMS' historical papers and myriads of related published documents, I realized that there was an intriguing saga that deserved to be told. Instead of the centennial history, I decided to pursue the emergent story by focusing on a biography of its founder, Dr. Charles P. Olivier. A professional astronomer, I wondered why Olivier invited amateur astronomers to be his colleagues in a research project. When I learned that the amateurs' observational contributions to meteor science were so substantial, it seemed just that they receive biographies too. So, biographical inquiries about them were added to the research plan for a history that spanned the years 1911–1936.

The book's outline became more complicated in the course of tracing Olivier's career history; research revealed a fascinating schism in the professional astronomical community. It needed to be described to provide context for his career. So, the book's plan now included Olivier and AMS members' biographies plus a story about the fissioning astronomical profession. That is how the AMS' history, originally an uncomplicated centennial one, became more complex even though shortened by 75 years. I believe the resulting story will interest readers of astronomical history and of science in general.

Charles Olivier and the Rise of Meteor Science is filled with biographies and some description of my background to write them follows. Before retirement, I practiced clinical and forensic psychology which required inquiries into people's histories. Biographical investigation was a fundamental aspect of my trade. It was natural for me to use the same skill set to learn about the figures in this book. I knew astronomers' lives were fascinating, having been introduced to them by Joseph Ashbrook's monthly column, Astronomical Scrapbook, in *Sky and Telescope* magazine. Opportunities to write brief biographies of Charles Olivier, for the *Biographical Encyclopedia of Astronomers* and the AMS' Web site, convinced me that I shared Ashbrook's enthusiasm for chronicling professional astronomers' careers. I became fascinated by amateurs' life stories; the first biographies I wrote were of Edwin F. Sawyer, a Boston meteor and variable star observer and Lewis

Swift the comet discoverer. Then in 2012 I began a blog, *Skywatchers* as a "test-bed" for writing biographies of forgotten amateur astronomers; it was where I practiced describing key incidents in the careers of citizen scientists that made contributions to astronomical knowledge. With this writing background, it was a natural progression to this book which showcases Professor Olivier's career from 1899–1936 and along with his scores of amateur astronomers' who volunteered to produce the data he analyzed and published.

The reader will see that the second half of the book contains AMS members' biographies. These were separated from the narratives about Olivier and the AMS' exploits in the first half of the book in order to preserve continuity of the historical account. Placement in the book's last half should not be interpreted to suggest that the amateurs' roles were secondary to the AMS saga. All of them devoted three or more years' effort to AMS research projects and, in fact, contributed the results which filled Dr. Olivier's meteor publications. These meteor-watching volunteers, active from 1911–1936, have in most AMS reports been identified only by their initials and family names, but here are portrayed in detailed biographies.

Professional psychology and writing biographies were not my only preparation to write *Charles Olivier and the Rise of Meteor Science.* I have been an amateur astronomer for most of the past 60 years. I have watched lunar and solar eclipses, drawn the moon and planets' surfaces seen through telescopes, timed disappearances of stars behind the dark edge of the moon, and spent 1,000 hours recording more than 9,000 meteors. Like the amateurs in Olivier's day, and their successors today, I have reported my observations' results to professional astronomers. I have drawn on my observational experiences while writing *Charles Olivier and the Rise of Meteor Science* and I hope I have successfully described what it is like to be under a dark starry sky patiently watching for "shooting stars."

Research preparation for this book has occupied the past 15 years and continued even as I wrote it in the last five. I have spent days prowling for information at three university libraries, at an observatory's archives, and at the Library of Congress. I learned a great deal about AMS observational methods and campaigns by studying observers' reports filed in the AMS' archives. I devoted many hours to perusing Olivier's early monographs and the historical vignettes he included in his columns in *Popular Astronomy*. Invaluable insights about Charles Olivier's life came from interviews with his daughters and other family members. Olivier's former graduate student assistants and senior AMS members who knew him personally provided further insights about him. Finally, conversations with adult children of the 1930s era observers gave me fascinating information about their fathers' lives that was not available anywhere else. The contents of this book have been enriched by all of these resources.

Charles Olivier and the Rise of Meteor Science may serve as your introduction to gravitational (or dynamical) astronomy, one whose accomplishments are not properly celebrated today. Meteor science is a branch of gravitational astronomy because meteors travel about the sun in orbits and a scientist needs to understand how the planets' gravitational fields influence those orbits. Gravitational astronomy is the oldest branch of scientific astronomy begun by Isaac Newton, Gottfried

Leibniz, and Pierre-Simon Laplace in the seventeenth and eighteenth centuries. It is the one that predicts when a comet like Halley's is expected to return to our sky, and its mathematics pinpointed the sky location where the planet Neptune was discovered, it also guided mankind's exploration voyages to the moon and has sent robot rovers to land on the surfaces of a comet, an asteroid, and the planets Venus and Mars. If *Charles Olivier and the Rise of Meteor Science* helps acquaint the reader with this unfamiliar and under-appreciated branch of astronomy, it will have served a useful purpose.

Camp Springs, MD, USA Richard Taibi

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Michael Morrow filled many voids in my archives of AMS publications and Karl and Wanda Simmons provided additional perspectives on AMS history by donating many early copies of *Meteor News*.

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Special thanks are due to Thomas R. Williams, Ph.D. whose knowledge of American professional and amateur astronomers and their organizations were of frequent help to me. In particular his pioneering efforts to publicize the roles of amateur astronomers encouraged me to do the same for those amateurs who contributed so much to the American Meteor Society's scientific results.

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About the Author

Richard Taibi is a retired clinical and forensic psychologist who has been an amateur astronomer for 58 years. In the last 32 years, he has specialized in recording and reporting (almost 10,000) meteor observations to national (American Meteor Society) and international (International Meteor Organization) meteor databases. He has published two astronomers' biographies (one is Charles P. Olivier in *Biographical Encyclopedia of Astronomers, Vol.2* and "Edwin Forrest Sawyer" in the IMO's *Journal* in 2004), and since 2012, he has published eight biographies of amateur astronomers on his blog, *Skywatchers*. Taibi has intensively studied American astronomy and astronomers both professional and amateur since 2001.

Abbreviations

AAS	American Astronomical Society
AAVSO	American Association of Variable Star Observers
AMS	American Meteor Society
FO	Flower Observatory
h	hour/hours
JRASC	Journal of the Royal Astronomical Society of Canada
MNRAS	Monthly Notices of the Royal Astronomical Society
PA	Pennsylvania
PA	Popular Astronomy
s	second/seconds
SAO/NASA ADS (Astrophysics Data System) web site	http://www.adsabs.harvard.edu/ A search engine that is very useful for locating journal articles
SPA	Society for Practical Astronomy
SSDI	Social Security Death Index
UPenn	University of Pennsylvania
USC	United States Census
UVA	University of Virginia
VA	Virginia

Introduction

Charles Pollard Olivier (1884–1975) was mentored from boyhood to be an astronomer by University of Virginia's observatory director, Professor Ormond Stone. Olivier's family home was located two miles from the university's McCormick Observatory and the young man was frequently inside its hemispheric dome being taught how to use the 33-foot (10 m.)-long telescope and related scientific accessories.

As important as that technical education was, Stone taught Olivier something more fundamental for his future career: the nature of subject matter appropriate to Astronomical Science. Stone was a practitioner of classical astronomy that emphasized accurate measurement of celestial bodies' sky locations (called *astrometry*) and the calculation of precise orbits in which stars, planets, and comets moved (called *gravitational astronomy, or, celestial mechanics*). Young Charles absorbed and adhered to Director Stone's instructions, particularly about how an astronomer should conduct research in the science.

Reform of bad science

In 1900, meteor astronomy was in a woeful state. It had suffered inept practice: specious celestial mechanics. A prominent English amateur observer, W.F. Denning had energetically cataloged thousands of meteor radiants, but he had fostered an erroneous theory which violated celestial mechanical realities. He exaggerated how many weeks meteors could physically be expected to come from the same spot, a meteor "radiant," in the sky. The result was that many of the long-enduring meteor displays Denning had cataloged were nonexistent: they could have no physical reality. Denning's apparent disregard of orbital realities severely irritated Olivier's scientific sensibilities. Just as intolerable to Olivier was the indifferent acceptance of this error by the era's professional astronomers; none of them stepped forward to object to Denning's work. Olivier knew that if meteoric astronomy was to enjoy the respect of competent astronomers, the field's apparent disregard of gravitational astronomy had to be corrected.

Dr. Olivier reformed meteor astronomy by advocating stringent observational practices which he described in professional papers and taught to members of the

American Meteor Society (AMS). From the AMS' founding in 1911 until 1930, he impugned published erroneous radiants using AMS members' meteor path drawings. Olivier's four AMS monographs, 1911–1929, contained observational evidence that the Orionid radiant, once claimed to be stationary was indeed in motion. He also demonstrated how imprecise radiant determinations failed to show movement in some radiants because their data masked the daily progression of the radiant in the sky. Olivier's masterful textbook review of meteoric astronomy, *Meteors*, marshaled comprehensive mathematical arguments against the existence of stationary radiants. In addition, his position as President of the International Astronomical Union's Meteor Commission offered the energetic and determined Olivier many opportunities to combat mistaken concepts and practices among his colleagues in other nations. Articles claiming that stationary and long-enduring radiants existed vanished from meteor publications by the end of the 1930s, if not earlier.

The citizen scientists of the American Meteor Society

Amateur meteor astronomers, members of Olivier's Meteor Society, were essential to his struggle to reform meteor science. They were a diverse corps of people who represented many educational and occupational backgrounds in the United States and the world; they were women and men, teenagers and adults, high school and college students, farmers and engineers, store clerks and lawyers, tradesmen and professors, railroad men and librarians, housewives and teachers, and ministers and business owners. Scores of these citizen scientists enrolled in the Society from 1911 to 1936; they furnished the meteor counts and meteor drawings which were the sources of Olivier's scientific papers. AMS members played an indispensable role in saving meteor science.

Charles Olivier and the Rise of Meteor Science contains a listing of all 277 citizen scientists who collaborated with Dr. Olivier from 1911–1936. They are identified by their full names, age at first participation, their educational background or their occupation as revealed in the US censuses or other reliable sources. For the first time, an inquisitive reader is able to learn who these citizen scientists were, who formerly were only identified by initials and family names and by their hometown. *Charles Olivier and the Rise of Meteor Science* is also first to identify women amateurs who contributed observational data and to fully recognize them in the same fashion as their male counterparts.

Almost 90 of these AMS members contributed meteor data for three years or more and are each the subject of a more detailed biography in Part II of *Charles Olivier and the Rise of Meteor Science*. The reader will discover familial, educational, marital, and occupational information about a cross section of United States citizens (and a few foreign ones) who dedicated many hours to careful astronomical data collection and who as a group significantly advanced astronomers' knowledge about meteor streams during the early 20th century

The relevance of meteor astronomy in the United States

From 1900 to 1940, American professional astronomers were leaving classical astronomy to pursue astrophysical studies, even then discovering some of the cosmos' secrets. Because meteor astronomy's goal is to determine meteor showers' orbits, it is a branch of classical astronomy. As such it was a member of the general class' diminishing stature among professional astronomers. For example, young professionals abandoned the gravitational study of double stars' orbits to pursue the study of those stars' physical compositions. Observatory directors were much more willing to hire astrophysicists than classical astronomers.

Even at universities and observatories which employed classical astronomers, there were very few meteor scientists. Years before the 1920s, meteor astronomy was being de-emphasized by astronomical institutions' scientists. However, Dr. Olivier's persistent investigations and publication of meteor discoveries began to reverse colleagues' aversion to the field. Dr. Olivier's treatise *Meteors* and his AMS reports, published by the McCormick Observatory and Carleton College from 1911–1936 gradually won support for meteor science among many astronomy professors in the USA. In 1911, Olivier's fellow graduate students at McCormick Observatory were his only observational collaborators. But, by the end of the 1920s, meteor investigations were started by astronomers in astronomy departments at three universities: Harvard's Harlow Shapley and Willard J. Fisher as well as Iowa's Charles Clayton Wylie and Iowa Wesleyan's Thomas Poulter. By 1936, there were five meteor-investigating organizations: the AMS, the Midwest Meteor Society, the Byrd Antarctic Expedition's meteor program, Harvard College Observatory's at Cambridge, and a joint Harvard-Cornell program in Flagstaff, Arizona. In addition, excitement about meteor studies generated a new scientific field. In 1933, the Society for Research on Meteorites (SRM) coined a term, *meteoritics*, to name their new specialty which emphasized the recovery and chemical analysis of meteorites. American meteor astronomy, in 1936 included three traditional atmospheric meteor research programs, two others which hoped to confirm claims of interstellar meteors, and the SRM extended the meteoric field's inquiry to meteoroids that reached the earth's surface. The astronomers who led the five newer organizations all sought prominent roles in meteor science. But competition with Olivier's AMS was not the only dynamic in the field, there was collaboration with it too. By 1936, college mathematics and astronomy professors in Florida, North Carolina, Ohio, Oregon, Texas, Utah, and Wisconsin were active AMS members who fielded their students to map meteors during the 1930s' Leonid showers.

Meteoric science was in disrepute and an irrelevant oddity at American observatories in 1911, but it regained an importance during the 1920s and '30s that it had last enjoyed in the 19th century. Charles Olivier and his Meteor Society deserved much of the credit for it.

Meteor science and public opinion

In the early 1900s, meteor science had lost the general public's trust. Meteor astronomers failed to warn the public that forecasting a meteor shower performance was an imperfect art and specifically that the 1899 Leonid meteors might not storm. Professionals were complacent and allowed newspapers to ramp up public expectations for a spectacle. When the Leonids fizzled, the public's reaction ranged from severe disappointment to hostile outrage with astronomers. The public complained of being misled. Meteor astronomers had a great deal of public relations repair to do after 1900.

Dr. Olivier was acutely aware of the public's disillusionment with meteor astronomy. So to minimize the chances of other public relations catastrophes, Olivier issued carefully nuanced announcements before the 1930s' Leonid showers which emphasized uncertainty about whether the upcoming shower would be a grand spectacle. He reminded the public that the Leonids had failed at the turn of the twentieth century. In order to minimize misleading announcements from AMS members, Olivier only permitted his carefully rehearsed regional directors to act as his spokesmen in their localities. In news articles about the Leonid showers, Olivier adopted the role of the inquiring scientist who needed to collect data to be sure of his conclusions. He asked the public to become a corps of citizen scientists, to act as his collaborators, by making hourly counts of Leonid showers during the 1930s. In this way, the public had a role in deciding whether or not the Leonids had stormed and in helping Olivier analyze the shower's output using data they contributed. Newspaper editors and their readers loved this arrangement and the public submitted thousands of observations for Olivier's analyses and reports. In addition to securing useful information the "pro-am" arrangement was beneficial for public relations: if the Leonids put on a meager show, the public could blame the shower and not the astronomer who warned them of its fickleness.

By his 50th birthday, in 1934, Charles Olivier had revived meteor studies in the USA and mentored their development in some nations abroad. American Meteor Society members and non-member citizen scientists had responded to Olivier's calls for help. Their data filled hourly rate, meteor train, and fireball radiant catalogs published by Olivier. Considering the prominence of astrophysics in the media during the 1930s, the public's endorsement of meteor science had saved it from obscurity and possibly total abandonment by the astronomical establishment.

Some Background: Meteors, Comets, and Their Orbits

Meteors are the visible incineration of *meteoroids* that are the debris from *comets*' disintegration. An immediate complication of that statement is that in a very few cases minor planets (asteroids) are known to be the source of meteor showers. However, to simplify the following exposition, comets will be assumed to be meteors' "parent bodies."

A meteoroid's life cycle

As comets approach the sun on each of their orbits, a layer of the icy matrix forming them melts or "sublimes" and in so doing rock-and-metal particles are liberated into interplanetary space. The particle, called a *meteoroid* is sent, by the force of its gaseous ejection into an orbit similar to the originating comet's. Over eons, because of planets' gravitational influences and even the pressure of sunlight, the meteoroid's distance from the parental comet may increase enormously, even to millions of miles (and kilometers) away from it.

Eventually, the meteoroid's orbit intersects the earth's and if the earth and the meteoroid arrive at the same point in space at the same time, the meteoroid enters the earth's atmosphere and vaporizes leaving a bright streak of light: a "meteor" or "shooting star."

Meteoroidal and cometary orbits

So far as is definitely known in historical times, a comet's orbit has not yet intersected earth's at a time when both bodies occupied the same spot at the same time. Fortunately, comets have given the earth a wide berth recently. However, meteoroids' orbits have intersected the earth's. The cometary particles are so faint as to be invisible in the night sky, and it is only when the meteoroids collide with and burn in the earth's atmosphere, as meteors, that astronomers learn of their existence and that an orbit existed that brought the meteoroid to a fiery end.

Meteoroids in the earth-bound orbit can be thought of as the "piecemeal arrival" of tiny portions of the parent comet when they impact the earth's air layer. When they arrive in large quantities over a short period of time, people experience them as a "meteor shower" which appears to come from a restricted area of the sky.

Problem: determining a meteor shower's orbit

Comets' orbits can be determined more definitely than meteoroids' because comets are visible for days and weeks. Their visibility allows their positions in the sky to be measured, and from these, the comet's orbit is calculated.

In contrast, meteoroids vanish in tenths of a second when their orbits direct them into the atmosphere. Their brevity, as meteors, leaves astronomers scrambling to deduce the orbit they traveled. Meteors do not persist long enough for astronomers to accurately locate them against the starry sky background, like they can do for the comet. In Dr. Olivier's era, before meteors could be captured on film, astronomers were forced to sketch meteors' paths on star maps as accurately as they could. After an hour or so, the meteor streak sketches, when prolonged backwards on the map, suggested a converging point of emanation in the sky, called a *radiant*. In a sense, the radiant indicates the presence and sky position of a virtual "astronomical body," defined by meteoroids, which was on a collision orbit with the earth. This piecemeal "body" is the only object whose sky position astronomers could measure like they did for a comet, in order to calculate the now-vanished meteoroids' orbit. This makes the radiant a key data variable in determining the shower's orbit.

But the radiant-as-virtual-heavenly-body-solution only posed more questions.

The first one was: How large a "spot" in the sky should be accepted as the meteor shower's radiant? Should the radiant area be as large as the full moon? Should it be as large as the area covered by the constellation Orion?

A second puzzle was to decide how many meteors per hour were sufficient to recognize that a radiant existed. In other words how much in-falling meteoroidal matter was needed to constitute the virtual astronomical body?

Then, meteor scientists were confronted with a third puzzle: how many days in a row should a single shower exist? In 24 hours, the earth moves almost 1,600,000 miles (2,600,000 km) further along on its orbit from the location it was at when the meteoroids' orbit first intersected the earth. Astronomers had to question the dimensions in space that this mass of ex-cometary particles could reasonably occupy as they pelted the earth. Could meteoroids from one shower strike the earth's atmosphere for many millions of miles of its orbit? How many days in a row could the same meteoroidal orbit intersect the earth's orbit? How many days must elapse before the two orbits parted company? Could a meteor shower continue for many months in a row?

Disputes between astronomers were created when each one asserted differing answers to the above questions. As detailed in this book the disputes lasted for decades. Dr. Olivier identified the source of these arguments in the first paragraph of a chapter concerning radiants in his book *Meteors*: "What appears the most simple is in fact very complicated…the lack of an exact definition of the word, and of a clear understanding of what properly constitutes a radiant, has introduced more false ideas and complicated or made useless more meteoric work than any other single difficulty met in pursuing the subject".