

Profiles in Astronomy and Related Sciences

William H. Waller

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William H. Waller Ph.D.

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Abstract

BUILD YOUR PROFILE FOR POSTERITY



1. What is your full name (first, middle, last),

William Howard Waller

your most published name,

William H. Waller

and your nickname?

Bill

2. When were you born? (day, month, year)

26, November, 1952

3. Where were you born? (city/town, state/province, nation)

Mount Vernon, New York, USA

4. What is your current nationality?

United States of America (USA)

5. What secondary, undergraduate, and graduate schools did you attend? Please list each school by name, state/province, country, and degree(s).

Rockport High School, Rockport, MA, USA (High School Diploma)

University of Arizona, Tucson, AZ, USA (B.S. in Physics and Astronomy)

Worcester Polytechnic Institute, Worcester, MA, USA (M.S. in [Optical] Physics)

6. What is your current institutional affiliation?

Rockport Public Schools, Rockport, MA, USA

7. What are your primary activities relating to Astronomy (research, education, public communication, amateur engagement, other)? Please rank from 1 (greatest focus) to 4 (least focus). Ties are OK. Further details are OK too.

Education – teaching physical sciences at high-school and college levels.

Public Communication – writing & editing general-interest articles and books relating to Astronomy. Giving public talks relating to Astronomy.

Research – multi-wavelength observations of star-forming activity in the Milky Way and nearby galaxies.

Amateur Engagement – member of the Gloucester Area Astronomy Club.

8. Some other identifiers which you may (or may not) choose to communicate publicly might include your gender, sexual orientation, marital status, race, ethnicity and religious faith.

I am a white male who has been married to Sandra Paille (a mechanical engineer) since 1985. We have two children, Julian (b. 1990) and Renée (b. 1995) who are currently enrolled in graduate and undergraduate school, respectively. I was brought up as a Judeo-Christian but do not have any specific religious allegiances.

9. What was your childhood like? (please feel free to elaborate)

I was born in 1952 in Mount Vernon, NY – a small city about 15 miles north of NYC. My mother, Pat Waller (née Wheeler) was a homemaker, writer and editor. My father, Marvin Waller, was a fine artist and illustrator who later became an architect. My sister, Susan Waller, preceded me by 1 year, 9 months, and 2 days – and so had to put up with me rather than the other way around. She manifested my father's artistic sensibilities at a very early age – with separate incidences of completely covering herself with our mother's makeup and our father's paints. Our family moved in 1958 from Mount Vernon, NY to Rockport, MA – a charming seaside town where I learned how to sail and where I first saw the Milky Way in all its mysterious splendor.

My childhood was fairly normal. I played Little League baseball and Junior Varsity basketball (poorly) and in high school competed in track and cross country running (decently). Beginning my freshman year, I participated in various theatrical productions and won a few acting awards. These theatrical endeavors helped to lay the groundwork for my later teaching and public speaking. By my senior year in high school (1969-1970), I was a long-haired anti-war activist, just like so many others during that contentious time. I led a protest march down the main street of my hometown and attended the Woodstock Music and Art Festival. Along the way, I maintained an abiding interest in Astronomy that was taken to the next level by a summer school course on "The Astronomical Perspective" taught by John Wood at Harvard University.

10. When did you first develop an interest in Astronomy and related sciences?

After I moved to Rockport at the age of 6 in October 1959, it took a few years for me to begin looking up. By the age of 10, I had become enraptured by the phases of the Moon, the perambulations of the planets (including some spectacular conjunctions), along with the diaphanous Milky Way. My astronomical interests were encouraged by my parents and other relatives, by having read books written by Isaac Asimov and Fred Hoyle, by the use of a spyglass given to me by my parents, along with the use of a larger telescope made available to me later on by a science teacher at Rockport High School.

11. What persons helped to support your interests and develop your skills relating to Astronomy? Here is your chance to publicly thank those who supported you during...

Secondary School (if applicable)

My high-school English teachers, Margaret Bowen and Gertrude Miller, helped me to organize my thoughts and communicate them in properly constructed sentences and paragraphs. Most of my writing from this time is lost, alas, but I still have a few poems and song compositions that remind me of their encouragements.

My Chemistry teacher, Phil Perry, gave me access to a windowless room – where I used his prism spectrometer to look at the emission from various salts that I ignited with a Bunsen burner. The unique patterns of spectral emission lines utterly enthralled me, setting me on the path to eventually studying the spectral line emission from galactic nebulae. Mr. Perry also lent me an antique brass refracting telescope on a tall wooden tripod which I used to observe Comet Bennett in 1970. Finally, Mr. Perry was our high school's drama guru and so was most responsible for coaching me in sundry thespian performances.

My Physics teacher, Bill Johnson, is best known as the inspiration for the character "Buzz Light Year" in the film Toy Story. Forty years after he taught me Physics at RHS, Bill graciously helped me to establish my own Physics teaching practice in the same classroom/laboratory that he had used!

Undergraduate School (if applicable)

Thomas Swihart was my designated advisor in the Astronomy Department at the University of Arizona. A mild-mannered and careful man, Prof. Swihart always listened to my various natterings with noble grace. I also think he gained some entertainment value from our casual conversations together.

Raymond White gave me my first opportunity to observe with a good size telescope in an observatory setting. Together with other UA classmates, I learned how to use the Steward Observatory 36-inch telescope in order to carry out photoelectric photometry of specific white dwarfs in the Milky Way. Finding these stellar notes in the midst of so many other stars proved to be hugely challenging. I nevertheless came away from this first observing experience completely dazzled by the sight of the Milky Way from a desert mountain top, entranced by the process of astronomical research, and wanting more of it. A former military man, Prof. White several times expressed that I should get some military training as a means of gaining more self-discipline. In hindsight, I could have benefited by taking his advice ?

Bart Bok was already famous for his pioneering research in galactic Astronomy, for directing several important observatories, and for being a wonderful popularizer of Astronomy. When I expressed to him my interests in galactic Astronomy, he generously gave me desk space in his office that occupied a major part of the original campus observatory. I did not merit such preferential treatment, and remain most grateful to this day. My update of the popular book on the Milky Way that Bart and his wife Priscilla co-wrote was partially motivated by this early kindness.

Graduate School (if applicable)

I was mentored by Ed O'Neill during my time studying optical Physics at Worcester Polytechnic Institute. Besides impressing me and my cohorts with his mastery of Fourier and quantum optics, Prof. O'Neill came to my rescue when my Master's degree was in jeopardy. He carefully shepherded me through the last steps of writing and defending my dissertation on actively-controlled long-baseline stellar interferometry, a selfless service to me for which I am very grateful.

Nick Scoville was my first mentor at the University of Massachusetts. He introduced me to the Five College Radio Astronomy Department's 14-meter mm-wave telescope and got me involved in the FCRAO-Stony Brook CO survey of the galactic plane. Nick was always great to be around, and his parties were the best! I did most of my work on the CO survey under the tutelage of Dave Sanders. He patiently led me through the various observing procedures at the radio telescope while regaling me with torrid tales of competition and intrigue within the molecular cloud research community.

Susan Kleinmann was my second mentor at UMass. Through her connections at MIT, Sue gave me my first opportunities to carry out CCD imaging of galaxies and reducing of the digital data that resulted. At times ferocious and at other times hilarious, Sue brought intelligence and passion to everything she did.

Stephen Strom was my third mentor and eventual Ph.D. dissertation advisor. Precociously brilliant and enthusiastic, Steve introduced me to the marvels of star formation along with the physical factors that may underlie the seemingly universal make-up of newborn stellar families – the so-called Initial Mass Function. From these considerations, I set out to assess the IMFs of stellar clusters that power HII regions. I did this by imaging the line and continuum emission that these HII regions produce. Although Chapter 3 of my dissertation suggests that the HII regions in the giant spiral galaxy M101 may be manifesting a spatial gradient in the stellar IMF – in retrospect – I now can see how variations in the HII regions' dust content may have produced the observed effects. Fortunately, the dissertation dealt with other issues of determining star formation rates, efficiencies, and environmental consequences, whose later corroboration by others have vindicated Steve's mentoring efforts.

David Van Blerkom made sure that my dissertation got the attention it needed in the final year. I had left UMass to teach at the University of Washington, and in some ways I had "fallen through the cracks." David helped to re-group the dissertation committee and get my thesis finalized. Thank you David!

I would be remiss to not give a "shout out" to all my graduate cohorts who made my life at UMass so collaborative, enriching, and fun. These include Lori Allen, Sylvie Cabrit, Mark Hemeon-Heyer, Jeff Kenney, Pat Knezek, Sue Madden, Jim Morgan, Kevin Olson, Rob Seaman, Beverly Smith, David and Denise Taylor, Linda Tacconi, Lowell Tacconi-Garman, Shuding Xie, and many others.

12. What was your first real "job" relating to Astronomy? (if applicable)

My first job in Astronomy was as a "data aid" at the Harvard-Smithsonian Center for Astrophysics. This was after my time at WPI and before enrolling in the Ph.D. program at UMass. I was good at some of the tasks that were given to me but not-so-good with others. So when there was an opportunity to become a science writer and public information specialist at the CfA, I took it. Jim Cornell was my cantankerous but benevolent boss for this job. I was purportedly paid by some creative accounting that involved paper clips in the office supply budget. Besides writing all sorts of general-interest articles on the research and education activities occurring at the CfA, this job also had me running the monthly lectures and public observatory nights. I even got to use their camera equipment on a trip to India, where I "covered" a solar eclipse and toured the subcontinent. Fond memories indeed!

During and shortly after graduate school, I had a lectureship at the University of Washington. This was arranged through the good graces of Paul Hodge at UW. Paul served as my unofficial mentor and became a dear friend. We ended up co-authoring

an updated version of his book on galaxies 15 years later. In 1990, I got a NAS/NRC resident research associateship at NASA's Goddard Space Flight Center. This was my first official post-graduate job. The opportunity to work with top scientists and to access the most amazing facilities was a fabulous experience for me. I am forever grateful to Bruce Woodgate who served as my postdoctoral advisor. Brilliant and congenial, Bruce was a joy to know.

13. What activities, experiences, or achievements relating to Astronomy have been most rewarding to you?

Most of my research has focused on understanding the circumstances and consequences of intense star-forming activity in nearby galaxies. In this pursuit, I have benefited greatly from being part of research teams and larger institutions. These included the FCRAO – Stony Brook Galactic Plane Survey team, Kitt Peak National Observatory (as a visiting graduate student), Goddard Fabry-Perot Imager team, Infrared Processing and Analysis Center (as a visiting postdoc), and Ultraviolet Imaging Telescope science team.

As a neophyte member of the FCRAO – Stony Brook Galactic Plane Survey team, I helped to show that massive stars form mostly inside giant molecular clouds rather than on their surfaces, as previously claimed. This finding implies that massive star formation does not require direct external triggering.

For my thesis work, I got to ride the technological wave of astronomical imaging with cooled electronic arrays. This enabled me to carry out photometric studies of star-forming activity in nearby galaxies – mostly using telescopes and CCD cameras at Kitt Peak National Observatory. I was able to see that the efficiency of massive star formation is fairly constant across the disks of spiral galaxies. By contrast, intense starburst regions operate at higher efficiencies – and with correspondingly shorter gas depletion timescales.

Working with all-sky data from the Infrared Astronomy Satellite, I helped to show that the Milky Way's interstellar medium is structured into a self-similar “froth” of filaments and shell fragments. This fractal construct remains unexplained.

Working with the Goddard Fabry-Perot Imager, I helped to characterize the line emitting properties of the bubble HII region N70 in the LMC. Enhancements in the [SII] vs. H-alpha line emission indicated nebular powering by shocks (likely from supernova blasts) in addition to the irradiation by UV photons from the remaining hot stars.

As a member of the Ultraviolet Imaging Telescope Science Team, I got to participate in the Astro-2 mission that operated aboard the Space Shuttle Endeavour in 1995. This was the biggest project that I had ever contributed to. It showed me just how much effort is expended by the finest minds in order to achieve success in a space mission. From the UV imagery, I helped to show that massive star formation is often orchestrated into discrete patterns such as rings, spiral arms, and “crooked” arms according to dynamical resonances that are set up in the disks of galaxies. I also found some evidence for spatio-temporal sequencing between the formation of molecular clouds, the birth of massive stars, and the subsequent evolution of the stellar populations across spiral arms – a behavior that is predicted by density wave theory. A personal highlight during my time at NASA/GSFC was helping to organize a conference on galaxy evolution and co-editing the proceedings book.

In education, I have enjoyed the privilege of introducing the wondrous contents, structure and history of the universe to thousands of undergraduate students. Mentoring undergraduate and graduate students in their astronomical research projects has been especially rewarding to me. I have also enjoyed providing professional development in Astronomy to K-12 teachers. A personal highlight in these regards was co-organizing a conference for educators on “Cosmos in the Classroom” at Tufts University and co-editing the proceedings book. As co-founder of the New England Space Science Initiative in Education (NESSIE), I helped to broker fruitful relations between NASA-supported scientists and educators of all stripes. More recently, I have been teaching high-school Physics. This continues to be intellectually rewarding and a lot of fun.

14. What are your current interests and activities relating to Astronomy?

In research, I continue to be fascinated by the interplay between newborn stellar populations and their nebular birthsites – what is known as stellar-nebular feedback. Do the most powerful stars abet further starbirth in their natal nebulae, or do they mostly disrupt and destroy their surroundings? More specifically, I would like to help ferret out the balance of radiative vs. mechanical powering that massive stars inflict upon their host clouds. Through appropriate analyses of available multi-wavelength imaging, I hope to learn which stellar inputs are most responsible for illuminating and shaping Wolf-Rayet nebulae, HII regions, and larger starburst regions.



In education, I continue to seek out new ways to bring the physical sciences to life for my high-school students. In 2014, I figured out how to determine the size of Earth by “taking a dip” at a nearby beach. My estimate came remarkably close to the mark – thus affirming the determination made by Eratosthenes more than 2200 years ago using similarly crude techniques! My students are especially fond of the experiment where we determine the speed of light by irradiating bars of chocolate in the microwave oven. Once the experiment is done, they use the warm chocolate to make s’mores – a big hit! I am also working hard to encourage and assist my advanced Physics students, as they carry out authentic research projects in Physics, Astronomy and other sciences. We now regularly participate in the Junior Science and Humanities Symposium (JSHS) that is held annually at the University of New Hampshire. The research projects that the diverse high-school students present at this event are truly inspiring! Most recently, I was given the opportunity to pilot a course on “Life in the Universe – A Deep History” that starts with the Hot Big Bang and explores the emergence of galaxies, stars, and planets along with the corresponding increase in chemical complexity that has led to life on Earth and perhaps elsewhere. What a wonderful topic for curious minds!



In public communication, I am keen to make The Galactic Inquirer online journal a popular forum for all things galactic (see <http://galacticinquirer.net>). Right now, we have feature articles and follow-up comments along with videos of various talks and musical performances relating to galactic Astronomy. We will soon pilot this series of “Profiles in Astronomy and Related Sciences” that we hope will be of interest to various astronomical organizations and their memberships.

Writing general-interest articles and books on Astronomy has engrossed me and given me lots of fulfillment. I look forward to doing lots more of this! I also look forward to editing and showcasing other people’s general-interest writing on Astronomy and related sciences.

My most exciting personal experiences relating to Astronomy have been the total solar eclipses that I have witnessed. From Winnipeg, Canada in 1976, to Hyderabad, India in 1980, Surabaya, Indonesia in 1983, and San José del Cabo, Mexico in 1991, I have whimpered like a dog during the plunge into totality and savored amazing views of the Sun’s active chromosphere and corona. I was able to share the Mexican eclipse with my wife, and eagerly look forward to sharing with my entire family the solar eclipse that will race across the heartland of America on 21 August 2017.

15. Are there any regrets that you would care to share?

Most of my regrets have to do with the scientific projects that I did not work through to completion. I still have interesting data and findings from observations with the Infrared Astronomy Satellite, Infrared Space Observatory, Hubble Space Telescope, and Spitzer Space Telescope that deserve writing up and submitting to a journal for peer review and ultimate publication. The common reason for these lapses is that funding for a particular project runs out, and a new funded project takes its place. Also, in the past 10 years, I have been doing lots more education and public outreach than research. Still, it’s frustrating and regretful.

16. What lessons-learned or other insights would you like to share with aspiring astronomers, etc?

First, the wonders of the cosmos are for everybody to explore as they see fit. No matter what your skill set and inclination, you will find compelling activities to pursue and similarly motivated people who are a good fit for you.

Second, if you pursue formal schooling in Astronomy, pick an advisor and stick close to him/her. Do not have two main advisors. That just leads to discord, based on my personal experience.

Third, make sure that you finish your degree work before leaving your school to pursue other opportunities. Once you are gone, you will drop off your advisors' radar and not get the attention you need.

Fourth and last, collaborations are a big part of succeeding as a scientific researcher, educator, administrator, communicator, or amateur. Honing your skills as a collaborator can only help you.

17. What non-astronomical activities are you engaged in that you would like to share?

Living in beautiful Rockport, MA, I get to go cross-country skiing, hiking, biking, sailing, and swimming. I also enjoy cooking for my family and friends. Together with my sister Susan Waller, I am slowly restoring the artwork of my late father Marvin Waller and making Giclée prints so that others can enjoy his wonderful paintings and drawings.

18. What other comments would you like to add?

I can be reached by e-mail at (williamhwaller "at" gmail "dot" com)