Preface

G P Zank
Editor, Proceedings of the 14th Annual International Astrophysics Conference,
Center for Space Plasma and Aeronomic Research (CSPAR) and Department of Space
Physics, University of Alabama in Huntsville, Huntsville AL 35805, USA

E-mail: garyp.zank@gmail.com

The 14th Annual International Astrophysics Conference was held at the Sheraton Tampa Riverwalk
Hotel, Tampa, Florida, USA, during the week of 19-24 April 2015. The meeting drew some 75
participants from all over the world, representing a wide range of interests and expertise in the
energization of particles from the perspectives of theory, modelling and simulations, and observations.
The theme of the meeting was “Linear and Nonlinear Particle Energization throughout the
Heliosphere and Beyond.” Energetic particles are ubiquitous to plasma environments, whether
collisionless such as the supersonic solar wind, the magnetospheres of planets, the exospheres of non-
magnetized planets and comets, the heliospheric – local interstellar boundary regions, interstellar
space and supernova remnant shocks, and stellar wind boundaries. Energetic particles are found too in
more collisional regions such as in the solar corona, dense regions of the interstellar medium,
accretion flows around stellar objects, to name a few. Particle acceleration occurs wherever plasma
boundaries, magnetic and electric fields, and turbulence are present. The meeting addressed the linear
and nonlinear physical processes underlying the variety of particle acceleration mechanisms, the role
of particle acceleration in shaping different environments, and acceleration processes common to
different regions. Both theory and observations were addressed with a view to encouraging cross-
disciplinary fertilization of ideas, concepts, and techniques. The meeting addressed all aspects of
particle acceleration in regions ranging from the Sun to the interplanetary medium to magnetospheres,
exospheres, and comets, the boundaries of the heliosphere, and beyond to supernova remnant shocks,
galactic jets, stellar winds, accretion flows, and more. The format of the meeting included 25-minute
presentations punctuated by two 40-minute talks, one by Len Fisk that provided an historical
overview of particle acceleration in the heliosphere (see the paper by Fisk, L., 50 Years of Research
on Particle Acceleration in the Heliosphere, in this volume), and another by Len Burlaga, who
presented a summary of the exciting new interstellar medium magnetic field observations being
returned by Voyager 1 (see the paper by Burlaga, L., Voyager Observations of the Magnetic Field in
the Heliosheath and the LISM, in this volume).

The meeting was dedicated to two people close to the Annual International Astrophysics Conference
series, to the conference participants, and the conference organizers. Both James (Jim) F. McKenzie
and Michael (Mike) Intriligator died in the past year. Brief obituaries of both are presented below.
Both will be missed greatly in our community.

We thank Adele Corona and ICNS for her continued excellent organization of the AIAC meetings and
her help in providing the logistical support for this volume of papers. I should also like to thank
Laxman Adhikari for his help with formatting a number of the submitted manuscripts.
Remembering James “Jim” Fairley McKenzie

Gary P. Zank

Jim McKenzie was the consummate theoretical mathematical physicist – like many of us attracted by the mathematical beauty and abstraction of theoretical physics, Jim’s greatest pleasure was to take a blank pad of paper, sit under a tree in his garden in Durban with a glass nearby, and an interesting problem to solve. I well remember Jim exhorting his young apprentices that we need to develop “algebraic muscle” – Jim’s algebraic muscle was honed by innumerable calculations across the broad field of electromagnetic theory, fluid and magneto-fluid mechanics, linear and nonlinear waves, space physics, and differential equations in general. Jim was possibly unreasonably proud of his theoretical inclinations. As a student, I occupied an apartment next door to Jim and Karen, Jim’s wife, for a year (I was house sitting) and shortly after I arrived, Jim stopped over, not for a social call, but because he needed some light bulbs changed in his house. As he explained, he understood and could calculate almost anything related to Maxwell’s equations, but the act of unscrewing and replacing one of Maxwell’s most important consequence, the light bulb, was more than he could or wanted to manage!

Unlike Jim’s contributions to the running of an orderly household, his contributions to science were important, far-reaching and profound. His first papers addressed radiation from fast moving particles – Cherenkov radiation – and as a young student I was very impressed to discover this work referenced in a number of classic texts, including Clemmow & Dougherty’s “Electrodynamics of Particles and Plasmas.” After Jim’s PhD from the Department of Applied Mathematics and Theoretical Physics, Cambridge in 1964, having been the Sir James Caird Scholar, he moved to the US as a National Academy of Sciences Research Fellow. He spent two years at the NASA Ames Research Center in the north of California, before moving south for a year to the University of California at San Diego. While in the US, he worked on one of his most interesting and far-reaching problems, addressing the interaction of waves with shock waves. This work was seminal and laid the foundations for everything done since on this topic in the field of space physics and astrophysics.

Jim’s travels took him from the US to Italy and then, as a Professor, to the University of Khartoum in Sudan for four years. After that, Jim found himself a Research Professor at the Danish Space Research Institute for roughly four years. Although he had spent time with Ian Axford, later to become Sir Ian Axford, in La Jolla at UCSD, it was only in the later 1970s that Jim’s very productive and influential collaboration with Ian began to flower. Their first important collaboration was a set of influential papers considering the acceleration of minor ions in the solar wind. These heavy ions tend to surf on the Alfvén waves of the solar wind, and Jim and Ian provided the early definitive models to describe the process. Almost all work since reflects the basic approach that they introduced.
In the early 1980s Jim moved to the University of Natal, which became his long-term home, along with a later concurrent appointment at the Max-Planck-Institute for Aeronomy (later renamed as the Max-Planck-Institute for Solar System Research). It was at the University of Natal in Durban that I first encountered the “curious Prof. McKenzie” with the strange accent and somewhat weird sense of humor, at least to the South African undergraduate students. I had the great pleasure of taking Jim’s first class – a final year class on “waves in fluids.” It was quite simply the best class that I had experienced at the time and it set me on my lifetime professional research path. Jim was a wonderful lecturer, at once profound, amusing, insightful, and always mathematically beautiful in his exposition. For an impressionable undergraduate not quite sure what he wanted to do, Jim made an indelible impression. Not surprisingly, after finishing my honors degree in Math and Applied Math, I began working with Jim towards my PhD, and under his astute guidance finished in record time. Jim was still collaborating closely with Ian Axford, now on the problem of cosmic ray acceleration by shocks. This period led to another series of profoundly important papers. It had long been conjectured that cosmic rays originated somehow from supernova remnants. Ian and Jim were instrumental in establishing that cosmic rays were accelerated at shock waves associated with supernova remnants. It is hard to over-emphasize the importance of this work. Diffusive shock acceleration, as it is now known, is truly a universal process, occurring throughout the universe. Virtually every issue of the Astrophysical Journal or similar will contain some reference to or application of the general theory of diffusive shock acceleration. Jim’s contributions laid the foundations for understanding the basic plasma physics of the process and will endure for as long as astrophysics is a discipline.

Jim’s contributions did not slow down. He wrote numerous papers on waves in the solar wind, introducing some important advances in interpreting nonlinear waves in multi-ion plasmas. A proceedings paper that had an enormous impact was an Axford & McKenzie discussion and investigation of mechanisms to heat the solar corona and thereby drive the supersonic solar wind. This work introduced the “furnace” idea and the notion of ion-cyclotron damping and thus heating of coronal plasma. The ion-cyclotron mechanism is regarded as one of the two most likely processes for heating the solar corona. Solar Probe Plus, to be launched in 2018, will test this idea by measuring the heated solar atmosphere directly. It’s a great pity that Jim did not live to see the possible confirmation of one of his great ideas.

It is impossible to capture the full extent of Jim’s research interests and activities. Suffice it to say that Jim’s contributions in many fields will continue to live on for years to come, inspiring new directions and ideas, and perhaps most importantly of all, inspiring young people to enter the world of mathematical physics through his beautiful presentations of complicated ideas. Whenever Jim visited me at the University of California, Riverside or the University of Alabama in Huntsville, I would always ask him to present a series of lectures to the students. Not only did the students find his classes inspirational, it brought back memories in me of a simpler and happy time long ago when I learned mathematical physics in the ivory tower that the University of Natal in Durban once was. Jim provided a link to that world and an idyllic time that is forever now extinguished. I, and all my colleagues, mourn Jim’s passing but will celebrate his legacy as a scientist of great distinction and renown.

Go in peace, Jim.
Mike (Michael) Intriligator, husband of Devrie Intriligator, an economist of note, died in Los Angeles on June 23, aged 76. He was an internationally renowned expert in econometrics, health care reform, strategy and arms control, peace and security, and transitioning economic and political systems. Mike met a number of us in the very earliest years of his career, and has since very frequently joined his wife Devrie at space physics meeting, including the AIA conferences. Indeed, Mike was a professor in three UCLA departments (economics, political science, and public policy), and became known for his work in the fields of economic theory and mathematical economics. His influential 1971 book, Mathematical Optimization and Economic Theory, brought previously inaccessible mathematical techniques into the mainstream of the field. "More than forty years later it is still one of the very best introductions to dynamic optimization," writes UCLA Professor John G. Riley. "After the book was published, a generation of economists with standard calculus skills were able to both appreciate and apply these techniques." Later in his career, Mike broadened his focus, applying econometric techniques to health care, strategy and arms control, nuclear proliferation, economic reform, warfare, and terrorism. A prolific writer and editor, Mike Intriligator wrote or edited more than 300 published research papers, journal articles, and books. Together with Nobel laureate Kenneth J. Arrow, he edited the 28-volume Handbook of Economics book series. Mike in fact co-authored a book with physicist David Goodstein in a 2013 book, entitled Climate Change and the Energy Problem. We like to think that this interest may have been stimulated in part by Mike’s frequent participation in the space physics conferences that he attended. Indeed, Mike could always be found at the back of the meeting room working on one or more problems or even sometimes listening with interest. Because of this, Mike was regarded as an honorary space physicist by many of us. All of us enjoyed wide-ranging conversation and discussions with Mike, who could convey his analyses and ideas in non-technical language. Dynamic and eloquent, he was an internationally sought-after speaker, and served as the "go to" person on several topics for many news sources. Mike was regularly interviewed on TV and radio, and quoted in newspapers. He contributed articles and op-ed pieces to the New York Times, Huffington Post, Truth-Dig, and other news, commentary, and analysis outlets. Michael D. Intriligator was born in Freeport, New York, February 5, 1938, received a Bachelor of Science degree in economics from MIT in 1959, a Master's degree in economics from Yale in 1960, and a Ph.D. in economics from MIT in 1963. Mike joined the UCLA faculty as an assistant professor of economics in 1963, where he remained for the rest of his career, rising to full professor of economics, with joint appointments in political science and policy studies. Mike served in numerous administrative positions throughout his career and won numerous honors. Notable among these was his election as a Foreign
Member of the Russian Academy of Sciences, the only American economist with that distinction. For all of us who knew Mike personally, he will be remembered as a gentle soul. His warm smile and genuine interest in others made him a pleasure to be with. Mike was outgoing and social, with a contagious joie de vivre. He maintained an immense range of friends, from many walks of life, and in many parts of the world. Mike will be missed by all of us.