

2022 ASAP Board Candidate Statements

Radio Astronomy

Esteban D. Araya I am a professor of Physics at Western Illinois University. My research interests focus on the study of high-mass star forming regions through continuum and spectroscopic observations at microwave frequencies. Since the early 2000's, I had the great opportunity of conducting research with Arecibo. The unprecedented sensitivity of the telescope for spectroscopic studies at ~5 GHz allowed me to pursue studies of molecular and atomic transitions in late type stellar objects, star forming regions and molecular clouds in the Milky Way and other galaxies. My research has also explored the synergy between the high sensitivity surveying capabilities of Arecibo and the imaging capabilities of the VLA. As a professor at Western Illinois University, I have guided graduate, undergraduate and high-school students in research projects based on Arecibo observations, and one of my most cherished mentoring activities was to take a group of students to conduct in-person observations at the observatory. I served on the Arecibo Observatory User's Committee from 2012 to 2015 and will be honored to continue serving the observatory. As a member of the board, I will stress the need for a Next Generation Arecibo Telescope with unrivaled spectral line sensitivity at cm wavelengths and an open-sky policy, to allow new generations of students to be inspired, just as many of us were inspired by using such an unique facility.

Thankful Cromartie I am currently an Einstein Postdoctoral Fellow at Cornell University. I am also chair of the Pulsar Timing working group within the North American Nanohertz Observatory for Gravitational Waves (NANOGrav) collaboration. My research concerns millisecond pulsars and their use as tools to probe low-frequency gravitational waves and the neutron star interior equation of state. I fell in love with the Arecibo Observatory during my time as an REU student in 2013 and used the Arecibo telescope extensively during my undergraduate and graduate studies. As I have been personally impacted by the observatory's ability to inspire young scientists and carry out cutting-edge research, I am running for an ASAP board position because I strongly believe in the future of the Arecibo Observatory and wish to help support its success. I would be grateful for the opportunity to contribute to discussions about a next-generation telescope and how to best advocate for such a project. I also hope to discuss strategies for communicating the importance of this effort to the larger scientific community. I believe the observatory can remain a powerful educational and scientific force for years to come.

Planetary Astronomy

Tracy Becker My affiliation with the Arecibo Observatory began in 2008 when I was an REU student working on radar observations of the first known near-Earth asteroid to have two moons. I credit that summer internship to launching my career in planetary science.

Since 2017 I have been serving as lead for science communications for the Arecibo Observatory through the UCF management contract with the NSF. I write science articles and facilities updates for the AO Newsletter in an effort to keep the entire science community, the public, and the NSF apprised of recent publications, exciting updates and upgrades at the facility, the incredible education programs, and the extraordinary, ongoing work by the scientists and staff at the Arecibo Observatory. Since the 305-meter telescope's collapse, it has been extremely important to showcase the current operations (e.g., 12-m telescope and the Remote Optical Facility) and the cutting-edge science being done with archived data to highlight the criticality of the telescope and the need for its replacement.

This is a critical time for the Arecibo Observatory. Through ASAP, it would be my goal to channel this awareness to the funding agencies and at the appropriate government levels to push for current, continued funding at the observatory and a strategic plan for future funding for the revival of facility as one of the most powerful radio telescopes in the world.

Robert V. Frampton is a retired aerospace engineer living in Pasadena, CA. He holds both a BS and MS degree in Astrophysics from Louisiana State University, Baton Rouge. He had further postgraduate work at University of Kentucky and UCLA in astrophysics, celestial mechanics and applied mathematics. He taught mathematics and astronomy at California State Polytechnic University for 5 years, then moved to Jet Propulsion Laboratory in Pasadena. At JPL, he worked on the Voyager Project for ten years and helped design the Voyager radio science occultation experiment at Jupiter and Saturn. After Voyager, he moved to Boeing Aerospace in Huntington Beach where he worked on spacecraft technologies. He visited Arecibo Observatory following the DPS meetings in Puerto Rico. He was a participant in the NSF Arecibo Options workshop in June, 2021. He has been active in ASAP and he originated the concept of a US Senate Resolution in support of Arecibo Observatory and wrote the first draft of what became US Senate Resolution 467, adopted by the Senate on December 2, 2021. Mr. Frampton is particularly interested in planetary radar capabilities for the next generation Arecibo Observatory,

Atmospheric Sciences

Paul Bernhardt (Geophysical Institute at the University of Alaska Fairbanks) is interested in joining the Arecibo Science Advocacy Partnership (ASAP). The primary goal of Paul A. Bernhardt on the ASAP is to advocate for reconstruction of a high-power HF Facility from the old Arecibo Dish. The motivation for an HF facility at Arecibo are (a) a pristine mid latitude ionosphere with a dense F-region lasting hours After sunset to study airglow enhancements, (b) magnetic field line connection to the conjugate ionosphere over Argentina, (c) a mid latitude E-region with sporadic-E structures that glow artificially and (d) a weak D-Region with low absorption of high-power HF. Arecibo has good proximity of manmade facilities including the ROTHF Over the Horizon Radars (Virginia, Texas, Puerto Rico), the NAU VLF Transmitter at 40.75 kHz in Aguada, Puerto Rico, access to space sensors in on low inclination satellites in low earth orbit on the ISS, COSMIC II, CubeSats, etc., access to active experiments with every NASA Cygnus flight starting June 2022, and to VIPER and Digisonde ionosondes on Puerto Rico. Dr. Bernhardt has been using Arecibo for active experiments since 1985 and has many publications in this area.

Jim “Rompe Todo” Breakall (WA3FET) received B.S. and M.S. degrees in Electrical Engineering from Penn State University and a Ph.D. in Electrical Engineering and Applied Physics from Case Western Reserve University, and has over 45 years of experience in numerical electromagnetics and antennas. He was a Project Engineer at the Lawrence Livermore National Laboratory (LLNL), Livermore, CA, and an Associate Professor at the Naval Postgraduate School (NPGS), Monterey, CA. Presently he is a Full Professor of Electrical Engineering at Penn State. Dr. Breakall was first at Arecibo Observatory in 1974 as the first Summer Student from Penn State. He worked with Dr. Rolf Dyce (Associate Director) on the design of the 100 ft dish at Higuillales that was used as an interferometer with the main 1000 ft dish. In 1977, he was a NSF Resident graduate student at the Arecibo Observatory in Puerto Rico working with Prof. John Mathews and Dr. Suman Ganguly on his Ph.D. research on antenna analysis and radar probing of the ionosphere using the 430 MHz incoherent scatter. At LLNL, he and his group worked on the development of the Numerical Electromagnetics Code (NEC), the first sophisticated antenna modeling program. Other significant projects that he has worked on were the designs of the HAARP facility in Alaska (patent received), both HF facilities at Arecibo (Islote and the recent Cassegrain sub-reflector design), and multiple feeds for inside the Gregorian Dome. He received a patent and the R&D 100 Award for the Kinstar low profile AM broadcast antenna. He has been and is a consultant to the Army, Air Force, and Navy, and Industry on antenna design and radio propagation. He also has designed many Amateur Radio commercial antennas including the very

Jim Breakall, continued

popular Ham Radio Skyhawk Yagi antenna, and he is the inventor of the Optimized Wideband Antenna (OWA). Dr. Breakall is also a life senior member of the IEEE Antennas and Propagation Society, IEEE Broadcast Technology Society, Eta Kappa Nu, International Union of Radio Science Commission B, IEEE Wave Propagation and Standards Committee, has been an Associate Editor for the Radio Science journal, and served as an Arecibo Observatory Users and Scientific Advising Committee Member. He has been a frequent speaker at the Dayton Hamvention Antenna Forum and has built two major contest super-stations near Penn State and on his farm in Puerto Rico near the big Arecibo dish. He has graduated numerous graduate students and received many awards over the years. In 2017, Dr. Breakall was awarded the prestigious Sarnoff Citation from the Radio Club of America (RCA), the oldest wireless society. He was elected as a Director to the Board in 2018 and 2021 and is the Chairman of their Technical Symposiums. He also serves on the RCA Scholarship Committee. He will be awarded Fellow this coming November.

Position statement: I have been part of the Arecibo family since 1974 and have made numerous trips there over the years. As some know, I even married a girl at the first house outside the gate where the VSQ is now located. I have many friends at the Observatory and throughout Puerto Rico also from Ham Radio. I own a farm a mile or so from the Observatory and built a big Ham Radio station there with Angel Vazquez that got destroyed by Hurricane Maria. Most people know me there as Senor Rompe Todo that is the Spanish translation of my last name. I have been actively working behind the scenes with several staff and other people there to get the one thing we see that can be brought back online quickly – the HF Facility.

Three of the 5 MHz antennas are back intact and the transmitters and power supplies were not damaged. Some parts of the transmission lines need to be replaced, and we need a new sub-reflector and some replacement of the primary surface. I have connected a company, Antenna Products, to propose a new sub-reflector with their experience of building the mesh ground screen at HAARP. I have been closely working with Dr. Dale Ferguson on some really clever ideas to get a Skycam type of feed installed that could do some really neat astronomy we believe. I also have a Ph.D. student working with Felix Rodriguez on a simple design of a Gregorian system for incoherent scatter. All of these things we believe can get the Observatory busy again in a few years while other more exotic design ideas are proposed and executed. Remember that the Observatory has some of the best state-of-the-art optical facilities still intact as well. I feel the ASAP Board and members will need to be fully behind these preliminary approaches to get Arecibo back on the research map as a viable facility in the near term and proposing other concepts for the long term. I believe I can offer the needed help and experience on both of these fronts and look forward to helping hopefully working with people such as Dr. Chip Cohen, Dr. Julio Urbina, Dr. Eliana Nossa,

Dr. Dale Ferguson, Dr. Paul Bernhardt, Dr. Mike Sulzer, and so many more of the staff there and others. I have been associated with Arecibo for most all of my life, and I could not think of a better facility to be involved with and help to become an even better scientific research center for the future. If I am elected to the Board, I will do my best to always think of all of the members and continue the historical and hopefully future greatness of “El Radar.”

Nathan ‘Chip’ Cohen (Cornell Ph.D. 1985 and former AO student and PI) I am an NAIC/Cornell student alumnus from the 70’s and 80’s, and conducted a great deal of spectral line observations at AO: many here know me by my younger self and the various brashness that entailed. Ah! Looking back!

My interest swung to antenna/array work and I did a VLBI thesis on gravitational lenses in 1985, amusingly still with Frank Drake as my advisor. With an absence of jobs I ended up at Wall Street as a ‘Quant’ and later returned as a professor at BU and head of their Science and Engineering Program (a STEP initiative). Fifteen years on, I was asked by the Marines to work full time solving their hidden antenna problem to stop IED’s, and have been an ‘industry scientist’ since, through the company I founded (Fractal Antenna Systems, Inc.)

My title is CEO and Master Inventor. I have 87 US patents and a good set of ears for listening. For the record, I have over 100 publications, although I dropped out of the publishing circle in favor of patents. The company’s customer list includes almost all government branches and entities ; telecom giants; Fortune 500 companies , and so on. Although you can’t blame me for the latest round of cell phone drop outs, the company was a pioneer in that tech arena. Today the emphasis is public safety and aerospace, as well as medical. The firm does not vend to astronomical nor related facilities and would not be part of any future AO bids. I am known to the public for my invention of fractal antennas, and the invisibility cloak. As such I have done basic science on invariance of Maxwell’s equations, forward scattering, and metamaterials and arrays. Mathematicians know me as the ‘fractal applications guy’. The below references (available on the web) provide an interesting perspective:

[Fractals - The Hidden Dimension NOVA HD - YouTube \(starting at 31:14\)](#)

[Why Mobile Phones Can Do So Many Things: The Invention of The Fractal Antenna - IEEE-USA InSight \(ieeeusa.org\)](#)

[Wideband Omnidirectional Microwave Cloaking | 2015-01-15 | Microwave Journal](#)

I see myself as a ‘subject matter expert’ on antennas and arrays, imaging, fractals, and navigating the human condition. I was managing editor of the journal FRACTALS from 2013-2018 and excel at ideation and its expression. I love putting disparate pieces together, constructively, whether its electromagnetic interference or people. My efforts have generated revenues well in excess of \$100,000,000. My inventions have generated revenues in the billions of dollars off-patent and outside of the US.

Chip Cohen, continued

By chance or effort, I have worn many hats which relate to seeing projects through and working the network to make it happen. Its been an enlightening journey from 'precocious punk' to the 'wise', not necessarily of my own choosing. But this has given me the needed perspective of being able to play devil's advocate on how technology initiatives will be seen outside of ASAP (and vetting them internally); how outside contractors may be overestimating expenses and underestimating time, as well as the cost effectiveness of proposed solutions. To be blunt, I am the guy you want assessing your proposal internally rather than the one reviewing it at the money source (a role I have played many, many times).

What happened at AO is a tragedy for many sciences. The dedication of its users is both heartening, and ultimately will be successful. But what we do now and our volition to push ahead will determine whether AO comes back on-line in 3 years rather than 30; and whether it can later transition from a modified cost effective retrofit to a state of the art observatory that will go into the 22nd century. Merit alone does not win the day; carefully asserted motivation is needed to drive the merit home. As I have the requisite experience, I would like the privilege of assisting in the leadership of the effort.

Erhan Kudeki I am an ECE Illinois faculty member since 1985, and a long time user of the Jicamarca and Arecibo incoherent scatter radars (ISR) with an interest in low- and mid-latitude E- and F-region plasma instabilities as well as in ISR signal spectral models and theories with a focus on perpendicular-to-B physics of thermally driven fluctuations in the ionosphere. My ionospheric radar work at Jicamarca also included technique development, and in particular development and applications of spatial and frequency domain interferometry as well as the use of differential phase techniques for ionospheric electron density measurements. I started using Arecibo for F-region ISR measurements after 2000 in connection with some graduate student projects that evolved with some colleagues at ECE Illinois (Lara Waldrop, Farzad Kamalabadi) and collaborated with other ISR users of Arecibo including Mike Sulzer, Nestor Aponte, and Juha Vierinen, most recently in the analysis and inversions of F-region and topside ISR data collected with coded and uncoded long pulse techniques and broadband USRP receivers enabling the full measurements of the ISR spectrum including the ion line and up- and-down shifted plasma lines. I have currently 3 PhD students working on these data acquired in post 2015 period.

Arecibo had the most sensitive ISR system in the world with unmatched capabilities. The loss of the Arecibo telescope has been a severe blow to ISR and ionosphere science. I was delighted to hear about the ASAP initiative to bring Arecibo back to life and would be honored to participate in its efforts to rebuild and improve the facilities for some new and exciting science.

Ian McCrea I have spent my research career working with the EISCAT radar systems in Northern Scandinavia, with a substantial amount of my time spent in planning and advocating for the new EISCAT_3D incoherent scatter radar systems. These will replace the dish-based EISCAT radars with a new multistatic phased array including new innovations in operations and capabilities, and promises to be the best system of its kind worldwide. I have also acted as co-chair and then chair of the URSI Incoherent Scatter Working Group, which brings together all the global ISR systems in coordinated “World Day” observations. In this role, I have been aware of the critical role of Arecibo in terms of providing low-latitude ISR observations. Before the demise of the “big dish”, Arecibo had unique capabilities, which could not be replaced by other sites, such as Jicamarca. Arecibo has made very innovative use of HF heating as well as supporting the excellent imaging work carried out at Cornell. Given its global importance, I would like to see the ISR capability at Arecibo re-established with a phased array capability, ideally one that exploits the same capabilities as EISCAT_3D and draws on the experience of the AMISR users and designers, such as the SRI group.

Julio Urbina received his BSEE degree from the Universidad Nacional de Ingenieria, Lima, Peru, and his M.S. and Ph.D. degrees in electrical engineering from the University of Illinois and Urbana-Champaign. He has worked at Jicamarca Radio Observatory, Arecibo Observatory, and University of Arkansas. He is currently and Associate Professor at Penn State. Dr. Urbina’s research has used radio and radar technologies to study the Earth’s middle and upper atmosphere. Dr. Urbina received the National Science Foundation CAREER award for his research on Cognitive Radar systems to study plasma instabilities. In 2015, Dr. Urbina received the Fulbright Scholar Award from the Department of State. Dr. Urbina is the Chair of IEEE Central Pennsylvania Section. He is also a member of the IEEE Antennas and Propagation Society, IEEE Aerospace and Electronic Systems Society, International Union of Radio Science Commission G, and CEDAR Science Steering Committee. He has been an Associate Editor for the *Journal of Atmospheric and Solar-Terrestrial Physics*, and served as an Arecibo Observatory Users and Scientific Advising Committee Member. He was elected as a Director to the Board of Radio Club of America (RCA) in 2020 and is the Chairman of their Education Committee. He also serves on the RCA Scholarship and Technical Symposium Committees. He has mentored many undergraduate students and has graduated numerous graduate students and received many awards over the years.

Position Statement: I first visited Arecibo in 1998 while I was a graduate student at University of Illinois at Urbana-Champaign, working under the supervision of Professor Erhan Kudeki. I conducted ionospheric research using Arecibo ISR

Julio Urbina, continued

data and provided ground-based radar support for the Coqui II NASA Rocket Campaign. Since then, I have made numerous trips to Arecibo over the years. My students have conducted research in instrumentation, meteors, ISR, and more recently using diverse data sets that demonstrate the uniqueness capabilities of Arecibo for space weather research. As a board member, I envision my role in communicating Arecibo's legacy and future opportunities in space science research. I will also promote and seek our community support to bring back Arecibo live as soon as possible to conduct ISR-HF research that when combined with state-of-the-art optical instruments can produce incomparable research results. I would also advocate for Arecibo's role in promoting the broadening participation in STEM fields from underrepresented groups. If I am elected to the Board, I look forward in working with colleagues such as Dr. Eliana Nossa, Dr. Dale Ferguson, Dr. Paul Bernhardt, Dr. Mike Sulzer, Dr. Chip Cohen, Dr. Jim Breakall, and many more to make the radar operational as soon as possible.

Juha Vierinen is an associate professor of space physics at University of Tromsø. He has worked in atmospheric and planetary radar using the EISCAT, Sondrestrom, Haystack, Arecibo, and Jicamarca observatories. He has developed a plasma-line receiver for Arecibo and, with the help of the AO staff, implemented it on the 430-MHz ISR. His design was then implemented as part of the permanent Arecibo system, and was the standard system that was used for 430-MHz ISR measurement until the cable failures in 2020. Juha has participated in heating experiments at Arecibo and EISCAT, and has done a wide variety of other observations, including making radar maps of the Moon at 50 MHz using Jicamarca. Juha has been to Arecibo many times, and recently served a term on the Arecibo Observatory Users Committee (AOUC).