

Report on the 2022 IEEE International Symposium on Antennas and Propagation and USNC–URSI Radio Science Meeting

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The 2022 IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting—AP-S/URSI 2022 (www.2022apsursi.org) was held from 10 to 15 July 2022, in Denver, Colorado, USA, the “Mile High City” (Figure 1). The conference was cosponsored by the IEEE Antennas and Propagation Society (AP-S) and the National Committee (USNC) for the International Union of Radio Science (URSI). It provided a leading international forum for the exchange of research ideas and dissemination of results in the fields of antennas, propagation, electromagnetic engineering, and radio science. It was exciting to have our flagship conference in Denver, for the first time ever, and back in Colorado after 50 years. Despite the unprecedented challenges related to the global situation with the pandemic, our 2022 edition was a truly memorable and most technically productive, professionally rewarding, and socially enjoyable event. Our attendees were openly and vividly enthusiastic about the opportunity to reboot, reset, reconnect, and reunite with colleagues and friends, most of whom they had not seen in person for three long years! And, of course, they were eager to make new connections and friendships for many years to come. In short, based on testimonies of the participants, the Denver conference was clearly a great success!

We had a late paper submission deadline due to the closeness of the AP-S/URSI 2021 Singapore conference (occurring with an almost half-a-year

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delay) and then needed to extend it further based on requests by authors. From the extended deadline to the paper acceptance e-mails and visa letters, reviews of papers were completed in a record short time. The number of accepted papers was about the same as Singapore 2021 (predominantly a virtual conference) and AP-S/URSI 2019 Atlanta (the last prepandemic in-person conference). The international distribution of submitted papers (per country) was as in prepandemic times.

The conference was held in person, with virtual presentations for authors and attendees unable to physically attend due to pandemic and visa issues. The highly illuminating and relevant technical program consisted of 1,371 orally presented papers placed in 15 parallel sessions each day of the conference (www.2022apsursi.org/technical_program.php) and no poster sessions. The sessions included a total of 437 virtual presentations, with the reason for converting the presentation from in-person to virtual being the pandemic in 247 cases and visa problems for 190 papers. The program featured 24 excellent special sessions, including several memorial sessions, and a diverse set of 11 engaging short courses and workshops, occurring on Sunday, 10 July.

We had 1,471 registered conference attendees, a number identical to the Atlanta 2019 (the last prepandemic flagship conference) registrations, and a record number (608) of student registrations. Registration fee rates were, on average, at the level of prepandemic conferences, with

a slight increase of regular registration fees and a drastic reduction in registration rates for students and retirees. There were many excellent travel grant opportunities (some “old,” some recent, and some brand new) and record numbers of travel grant awardees among students, women, and other attendees.

The conference venue consisted of two outstanding nearby hotels in historic Lower Downtown—the Hyatt Regency and Grand Hyatt—with spectacular conference spaces,

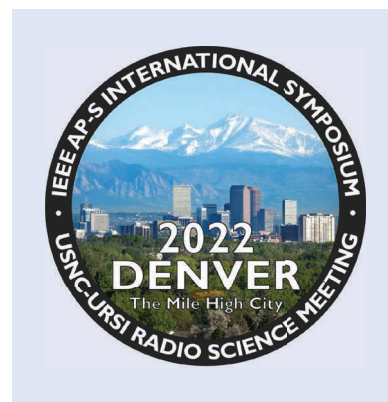


FIGURE 1. The AP-S/URSI 2022 Denver logo. With an outstanding technical program, many new activities, and organized social events within the city and its spectacular surroundings, our 2022 edition in Denver was a great success.

ballrooms, meeting rooms, and excellent guestrooms at great conference rates (www.2022apsursi.org/venue.php) (Figure 2). Our venue was at 5,280 ft, or 1,609 m, (a mile) above sea level. Conference attendees also enjoyed unforgettable views of nearby mountain peaks, some reaching 14,000 ft (see Figure 1). Many conference participants brought their family and friends for a great combination of work and play. Accompanying person activities included Colorado sightseeing tours and memorable interactions in the stunning Companion Suite at

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Peaks Lounge, atop the 27-story Hyatt Regency, with breathtaking panoramic views of downtown Denver and the surrounding Rocky Mountains.

A signature of the Denver conference was our efforts to enhance impactful industry involvement and presence within the AP-S to complement our academic/university strengths. As a part of this, we prepared a truly spectacular exhibit hall and recruited, despite the challenges mentioned earlier, more sponsors (including diamond) and exhibitors than prior AP-S/URSI conferences. This included 12 sponsorship contracts, and 43 companies and six non-profit organizations completely filling the available exhibit booths (Figure 3) (www.2022apsursi.org/sponsors_exhibitors.php). In addition, 10 companies ran scheduled interactive demonstrations in the specially assigned area in the exhibit hall. The exhibit hall and large foyer in front of it were the heart of the conference activities and interactions.

We introduced and organized many new events and activities for the Denver conference that were not done before (www.2022apsursi.org/registration.asp), and all were very well received. One of the biggest new initiatives was “Industry Day” on Thursday, 14 July, including plenary talks; industry special sessions; Young Professionals career development and growth conversations, with 10 industry, academic, and government leaders providing career guidance through small group gatherings; and an evening university–industry reception to conclude the day, with keynote speakers and conference sponsors and exhibitors at hand.

The AP-S/URSI 2022 Denver plenary session was the first one in recent memory, with three outstanding and very diverse keynote talks coming from industry, government, and large international collaboration, respectively. The session highlighted 1) “AP-S Distinguished Industry Speaker Series Talk: Amazon’s Project Kuiper: Overcoming Antenna Design Challenges to Advance Global Broadband Connectivity and Reach Unserved and Under-served Communities,” by Dr. Nima Mahanfar, a founding team member of Project Kuiper; 2) “AP-S/URSI 2022 Keynote Talk: Antennas Outside of the



FIGURE 2. Denver, the “Mile High City,” and Hyatt Regency Denver Hotel were welcoming AP-S/URSI 2022 participants in July 2022.



FIGURE 3. The conference exhibit hall featured record numbers of sponsors (12, including diamond) and exhibitors (49), enabling invaluable interactions, information exchanges, and networking among all conference participants.

Box,” by Dr. Dev Palmer, deputy director, DARPA Microsystems Technology Office; and 3) “AP-S/URSI 2022 Keynote Talk: Event Horizon Telescope Imaging of Black Holes: How Antenna Arrays Discovered a Black Hole at the Center of Our Galaxy!” by Dr. Geoffrey Bower, chief project scientist for the Event Horizon Telescope Collaboration (www.2022apsursi.org/plenary_talks.php). The plenary session was extremely well attended and received, with lively discussion and many questions following each talk.

The largest gathering of the conference was the welcome reception, on Monday, 11 July, at the Wings Over the Rockies Air and Space Museum, a World War II aircraft hangar converted into an extremely interesting museum, with a unique and gigantic place where all our attendees and their families were able to entertain together (www.2022apsursi.org/social_program.php). We had A-7 and F-111 open cockpits for everyone to climb into and explore, with Wings staff explaining the inner workings of these historic aircraft, as well as flight simulators, where our attendees and their family members bravely flew fighter jets with full-motion 3D “Top Gun” experiences. Some attendees were flying radio-controlled planes, coached by Wings instructors. There was a blimp (dirigible) with the AP-S/URSI 2022 Denver logo (see Figure 1) flying around and periodically dropping prizes for lucky attendees. It was fantastic to see so many happy faces having fun together (Figure 4).

The Students and Young Professionals Networking and Dinner Event was held on Tuesday, 12 July, at Wynkoop Denver, a Colorado-authentic historic place visited by many celebrities and U.S. presidents. Our Students and Young Professionals, and advisors alike, enjoyed tremendously the 15 tournament-sized billiards tables, foosballs, and other games. Simply, everybody had a “blast” that evening. We all witnessed a miraculous creation of friendships and networks during these fun competitions and interactions, many of which were further enhanced at subsequent technical, professional, and social events of the conference.

Our awards ceremony, on Wednesday, 13 July (Figure 5), highlighted four IEEE-level awards (the 2022, 2021, and 2020 IEEE Electromagnetics Awards and 2020 Tomiyasu Award) presented by the 2022 IEEE president, Prof. Ray Liu, and many AP-S field awards and paper awards, presented by the AP-S president, Prof. Gianluca Lazzi, as well as Chapter awards and travel grants. A “novelty” here was a jazz quartet playing “walk-up tunes” as the awardees were walking to the stage and photos were taken. Especially amusing were

the “drumrolls” prior to announcements of the third, second, and first places for winners of the AP-S Student Paper Competition and AP-S Student Design Contest, respectively (these winners were kept secret until then), with the “drumrolls” being noticeably loudest when the first-place winners were just to be announced.

This was followed by the conference banquet, which celebrated the conference, awardees, authors, members, and attendees. The conference general chair presented certificates of recognition to

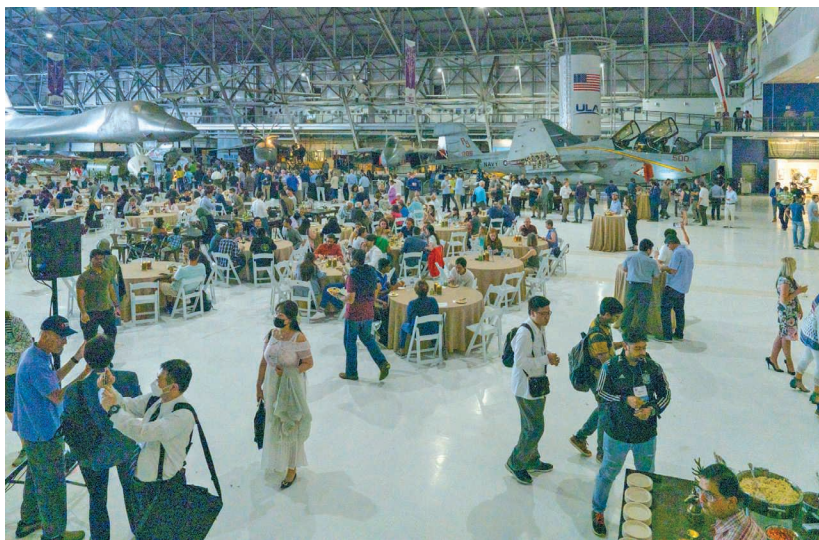


FIGURE 4. The welcome reception (Monday, 11 July), at the Wings Over the Rockies Air and Space Museum, where AP-S/URSI 2022 attendees and their family members rode “Top Gun” flight simulators, explored open aircraft cockpits, flew drones, and danced to the songs of the Colorado Country Music Band.



FIGURE 5. The AP-S/URSI 2022 awards ceremony (Wednesday, 13 July) highlighted a record number of IEEE-level awards, presented by the 2022 IEEE president, Prof. Ray Liu, and many AP-S Field, Paper, Chapter, Travel, Student Paper Competition, and Student Design Contest awards, presented by the AP-S president, Prof. Gianluca Lazzi.

conference sponsors and members of the Steering and Organizing Committee (Figure 6). The entertainment was by the fantastic 11-member Denver's Radio Band, with a packed dancing floor for 2.5 h. The comments were that we almost never had such a massive and long dancing "session" at AP-S/URSI conference banquets, another indication that people craved face-to-face social interactions along with technical and professional ones.

A master class, "Nonionizing Electromagnetic Wave Interactions With Human Tissue: Opportunities for

Advancing Healthcare Technologies," compellingly delivered by Prof. Susan Hagness on Monday, 11 July, was the first in-person AP-S Master Class. It drew a large audience and ignited a vibrant discussion. The Women in Engineering and Radio Science Lunch event, on Tuesday, 12 July, featured Prof. Zoya Popovic, who passionately and reflectively delivered "Choosing Role Models for a Successful Career" (Figure 7). During the Reviewers' Lunch, on Wednesday, 13 July, the editors-in-chief of AP-S journals presented the state of the publications, current activities, and future

plans. In addition, the AP-S Administrative Committee, all AP-S standing committees, editorial boards, and participating USNC-URSI commissions held their business meetings at various times throughout the conference.

The Denver conference made concerted efforts to make the last day of the conference (Friday, 15 July) more interesting for everyone to, as much as possible, avoid the usual situation with attendees, especially students, presenting on Friday in almost empty conference rooms, with deserted hallways and breaks. We introduced a closing reception on Friday evening as a celebration of the conference, with food, drinks, and live entertainment. The reception was, somewhat unexpectedly, a stunning success, with a very large number of attendees relaxing after a full week of papers, presentations, courses, demos, technical discussions, professional meetings, and social activities and celebrating memorable experiences in Denver (Figure 8). We also introduced an enlightening interactive panel with IEEE and AP-S awardees during the Friday lunch break, with highlights of their technical achievements, career and life paths, reflections, and guidance to the audience.

To further make the end of the conference more interesting, we organized a Conference Networking Event: A Private AP-S/URSI 2022 Organized Tour



FIGURE 6. The conference general chair presents a certificate of recognition to the AP-S/URSI 2022 diamond sponsor (the highest sponsorship and first in recent memory), Lockheed Martin Space, at the conference banquet (Wednesday).



FIGURE 7. A group of participants of the AP-S/URSI 2022 Women in Engineering and Radio Science Lunch event, on Tuesday, 12 July.

of Rocky Mountains, on Saturday, 16 July. We visited the spectacular Rocky Mountain National Park, one of the oldest and most-visited national parks in the United States, in buses with expert tour guides, riding along the Trail Ridge Road, which is the highest motorway in the country (Figure 9). We picnicked in the “Land Above the Trees,” at 11,796 ft (3,595 m) above sea level, feeling like we were on the top of the world, with fascinating alpine tundra landscapes and nearby mountain peaks reaching almost 14,000 ft. We saw some beautiful elk, deer, bighorn sheep, and moose. We stopped at the Continental Divide,

the undrawn line traversing all of the Americas to separate drainages to the Atlantic and the Pacific, and hiked the Roaring River, displaying the equally magnificent and destructive power of nature. These venues were truly unique and spectacular, and this tour was a great “avenue” for networking and “Society” building.

Based on all the statistics and measurable outcomes, as well as hundreds of face-to-face comments and e-mail messages I have received from the authors and participants, the conference was a great success. This is evident especially when assessed by the happiness

and gratefulness of the attendees, and I believe the students most noticeably. On behalf of all AP-S/URSI 2022 Denver participants, I would like to thank Prof. Dejan Filipovic, vice-general chair; Prof. Andrew Peterson, Technical Program Committee (TPC) chair; Profs. David Jackson, Karl Warnick, and Stephen Gedney, TPC cochairs; Prof. Olivera Notaroš, local arrangements chair; and all members of the Steering and Organizing Committee of our conference (www.2022apsursi.org/organizing_committee.php) for their fantastic collaboration and time, effort, and spirit in making this happen despite all of the unprecedented challenges.

It was my utmost honor and pleasure to be of service to the AP-S, URSI, and electromagnetics community and lead the organization of AP-S/URSI 2022 and host so many great researchers, educators, practitioners, and students in antennas, propagation, electromagnetic engineering, and radio science, all fantastic colleagues and friends, in Denver in July. As I mentioned at the welcome and closing receptions and conference banquet, the preparations for this one-week event lasted exactly four years, and it was a once-in-a-lifetime opportunity and adventure. Many international attendees visited the United States for the first time. Many U.S. attendees visited Colorado and the “Mile High City” for the first time. And almost all AP-S/URSI 2022 delegates visited Wings, Wynkoop, the Hyatt Regency Denver, and Rocky Mountain National Park for the first time. To all, please visit again! And I hope to see you all and many others at our future flagship conferences throughout the world.

AUTHOR INFORMATION

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FIGURE 8. A group of students celebrating the successful completion of the conference at the AP-S/URSI 2022 closing reception, on Friday, 15 July. Subtracting the general chair, the future of the AP-S is clearly bright!



FIGURE 9. AP-S/URSI 2022 participants enjoy the “roller coaster” experience at the highest tipping point—at a 12,183-ft (3,713-m) altitude—of our tour of the truly spectacular Rocky Mountain National Park, on Saturday, 16 July.