

The Maui International Double Star Conference

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Abstract: A three-day double star conference in February, 2013, covered double star observations from simple eyepiece astrometry of wide binaries, with orbital periods of centuries, to amplitude interferometry of binaries with periods measured in days or even hours. A wide range of participants, from students and amateurs to professionals shared their perspectives in panel discussions. This was the first conference of the newly-formed International Association of Double Star Observers (IADSO). PDFs of 22 of the talks and YouTube links to 23 of the talks and panels are available at www.IADSO.org.

The Maui International Double Star Conference was held 8-10 February, 2013, at the University of Hawaii's Institute for Astronomy Makialani, Pukalani, Maui, Hawaii. This was the first conference of the newly formed International Association of Double Star Observers (IADSO).

Many of the conference participants went on a pre-conference Atlantis submarine cruise on February 6th. The Atlantis submarine, which holds 48 people, reached a depth of 129 feet while cruising around reefs and old shipwrecks not far from Lahina. Steve McGaughey, a conference participant and resident of Maui, is one of the submarine's captains.

The submarine tour was followed by lunch at the historic Pioneer Inn and a tour of old town Lahaina, the first capital of Hawaii, and for many years its busiest port.



Figure 1: IADSO conference participants pose in front of the University of Hawaii's Institute for Astronomy, Makialani.

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Figure 2: Lined up on the deck before going below. Ellie and Steve McGaughey, Oleg Malkov, and Yury Balega.



Figure 3: A bright fish swims by a sunken wreck. Captain Steve McGaughey safely brings us back to shore.



Figure 4: Group hug after lunch at the Pioneer Inn. Left to right: Bill Hartkopf, Suzanne & Chris Thueman, Russ Genet (in back), Ellie & Steve McGaughey, the peg-legged sea captain, Oleg Malkov & Irina Arendarchuk (behind), Vera Wallen, and Yuri Balega. An enormous Banyan tree (right) takes up most of a block-sized park in Lahaina. Vera Wallen, Jo Johnson, Cheryl & Russ Genet pose in its shade.

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Figure 5: Bill Hartkopf, Russ and Cheryl Genet in front of Pan-STARRS. Bobby Johnson and Eric Weise at the working end of the 2-meter Faulkes Telescope North.

Another pre-conference tour, this one on February 7th included a Haleakala summit tour of Pan-STARRS (now of Comet Pan-STARRS fame), the 2-meter Faulkes Telescope North (part of the Las Cumbres Observatory Global Network), and the Haleakala Amateur Astronomers observatory (perhaps the highest amateur observatory on the planet).

Pre-conference activities were capped off with a sunset dinner at the famous Kula Lodge on the flank of Haleakala. The wine and food were excellent!

The conference covered many aspects of visual double star astrometry. Invited talks and contributed posters addressed double star instrumentation, observations, orbital analysis, catalogs, organizations, jour-



Figure 6: Sunset dinner at the Kula Lodge on the slopes of Haleakala.

nals, and student research. Observational techniques from simple visual astrometric eyepieces to CCD astrometry of fainter doubles were discussed, along with high resolution techniques including speckle interferometry, amplitude interferometry, and intensity interferometry. Talks on complementary instrumentation included high resolution radial velocity spectroscopy and low cost, portable meter-class “light bucket” telescopes for spectroscopy and intensity interferometry.

Many of the talks were given by student and amateur astronomers on their double star observations made with smaller telescopes. At the other end of the spectrum, there were talks on observations of very close binaries made with the 3.5 meter WIYN telescope at Kitt Peak and the historic 6 meter telescope of the (Russian) Special Astrophysical Observatory. Consideration was given throughout the conference to student education—how undergraduate and even high school students can learn about science by conducting their own double star research. Being a published “scientist” significantly advances educational careers.

The conference was called to order Friday morning, February 8th, by its convener, Russ Genet, who

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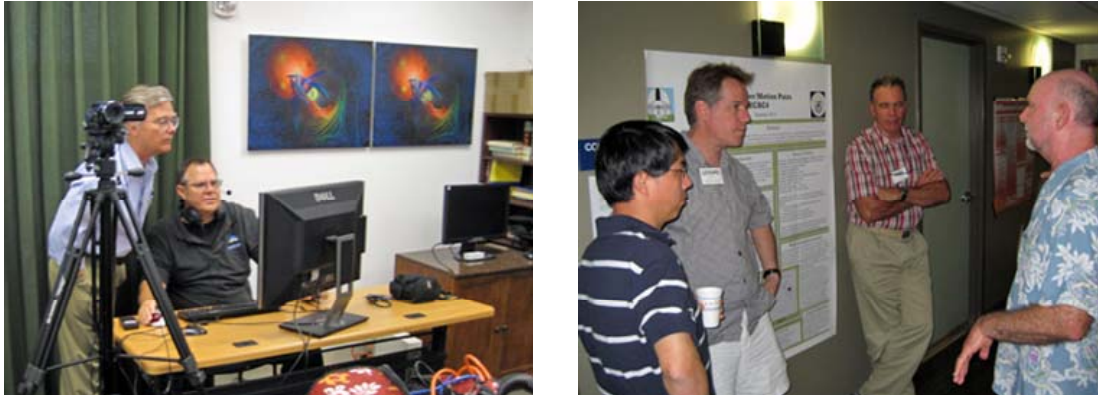


Figure 7: Bob Buchheim and Steph Mohr faithfully record each of the presentations for posterity. PDFs of the power point slides and links to U-Tube videos are available on www.IADSO.org. Jian Ge, Gerard van Belle, Chris Thueman, and Steve McGaughey discuss one of the posters during break.

introduced the Master of Ceremonies, Jolyon Johnson. Joe Ritter, gave a welcome from the University of Hawaii's Institute for Astronomy, while Steve McGaughey did the same for the Haleakala Amateur Astronomers. Steve McGaughey and Cheryl Genet (the Conference Facilitator), provided details on meals and special events.

The first two sessions placed emphasis on student and amateur research at smaller telescopes. Jo Johnson (California State University, Chico) gave the first talk of the conference on undergraduate double star research seminars, followed by a talk by Russ Genet (California Polytechnic State University) on a student speckle interferometry research program. R. Kent Clark (University of South Alabama and Editor of the *Journal of Double Star Observations*) considered the latest trends in double star astronomy in the *JDSO*, which publishes many amateur and student papers. Paul Hardersen (University of North Dakota, Space Studies Program) explained how the development of their astronomical research program led to the unique University of North Dakota graduate distance learning program which offers both masters and doctoral degrees in Space Studies with an astronomy option. Robert Buchheim (Altimira Observatory in California) rounded out the first session by enumerating the support the Society for Astronomical Science (SAS) provides to both amateur and student researchers in many areas, including double stars. The SAS's popular annual late May symposium at Big Bear Lake in southern California is well worth attending.

The second two sessions continued the small telescope double star research theme. Bruce MacEvoy (Black Oak Observatory in northern California) described his visual double star campaign from his well-equipped observatory. Eric Weise (a third year physics and mathematics student at the University of Califor-



Figure 8: The student education panel (left to right): Kent Clark, Bob Buchheim, Eric Weise, Vera Wallen (panel moderator), Jo Johnson, and Russ Genet.

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Figure 9: Social hour at the Maui Beach Hotel. Left to right: Vera Wallen, Deborah and Bill Hartkopf, Russ and Cheryl Genet, and Elliott Horch. Dinner at Tante's Island Cuisine.

nia, San Diego) provided a student-teacher perspective on double star research seminars. Kakkala Mohanan and Rebecca Church (an instructor and student, respectively, at Leeward Community College, Oahu, Hawaii) described double star lucky imaging astrometry with their 0.5-meter telescope. A panel on student research and education, led by Vera Wallen (retired Superintendent of Schools in California), considered various student educational issues. With a good first day under their belts, the attendees retired for a social hour at the Maui Beach Hotel and dinner at Tante's Island Cuisine in Kahului.

Sessions continued on Saturday morning, February 9th, with talks by professional astronomers. William Hartkopf (U.S. Naval Observatory, Astrometry Department) described the Washington Double Star Catalog in terms of "whence it came," and "whither it goeth." Oleg Malkov (Institute of Astronomy, Moscow) described how he formed catalogues of fundamental parameters of orbital binaries. Elliott Horch (Physics Department at Southern Connecticut University) reviewed his speckle interferometry at the 3.5 meter WIYN Telescope at Kitt Peak. Yury Balega (Director of the Special Astrophysical Observatory, Russian Academy of Sciences) described the intriguing puzzles of the young massive binary Theta 1 Ori C. Brian Mason (U.S. Naval Observatory, Astrometry Department) outlined the extensive USNO double star observing program. Observations are made both with the historic Alvin Clark refractor in Washington and as guest observers on many larger telescopes in the USNO's "off campus" program. Brian was unable to attend in person, so Bill



Figure 10: The famous 26-inch (0.66 m) Alvin Clark & Sons refractor at the US Naval Observatory dwarfs Bill Hartkopf and Brian Mason as they discuss a speckle interferometry run with their colleagues. The pioneering 6 meter telescope of Russia's Special Astrophysical Observatory, on the right, which Yury Balega directs. Yury spent many 14-hour nights in the prime focus cage.

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Figure 11: Elliott Horch and his two-channel speckle interferometer mounted on one of the two Nasmyth foci of the 3.5 meter WIYN telescope at Kitt Peak. One of the two Andor iXon EMCCD cameras can be seen as well as a PC strapped to the bottom of the photometer. Russ and Elliott in the warm room during a recent run.

Hartkopf gave his talk for him. Yury Balega also gave a talk on the pioneering 6-meter azimuthal telescope in southern Russia—formerly the largest telescope in the world.

Saturday afternoon returned to amateur and student talks. Ed Wiley (Yankee Tank Creek Observatory, Kansas) described the autocorrelation techniques he uses on “super speckles” with his small telescope. B. J. Fulton (Institute for Astronomy, University of Hawaii at Manoa) addressed the fundamentals of speckle interferometry reduction. Steve McGaughey described how Maui students—including high school and even middle school students—conduct double star research on the 2-meter Faulks Telescope North. The conference’s second panel was moderated by Elliott Horch.



Figure 12: Ed Wiley’s f/22 Dall Kirkham telescope he uses to observe double star “super speckles.” The second panel (left to right): Bill Hartkopf, Ed Wiley, Elliott Horch (moderator), Steve McGaughey, and B. J. Fulton.

Most of the attendees participated in an evening observing session at Haleakala Amateur Astronomer’s Observatory. It was cold and a bit windy but clear, and the seeing was excellent.

Sunday, February 10th, the final day of the conference featured advanced techniques. Gerard van Belle (Lowell Observatory and President of the IAU Commission on Optical and Near Infrared Interferometry) gave talks on the fundamentals of amplitude interferometry and their application at NPOI, CHARA, and elsewhere. David Dunham (President of the International Occultation Timing Association and member of

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Figure 13: Bobby (left) works with his team at Arroyo Grande High School to analyze lucky images of the double star, 69 And. He presented his results at the conference in Maui (right). Bobby plans on becoming an astrophysicist.

the Moscow Institute of Electronics and Mathematics) explained how to obtain high speed lunar occultations of double stars. Jian Gee (University of Florida Research Foundation) described the development of a low cost, portable, next-generation, extremely high resolution optical /near IR spectrograph.

John Martinez (Las Cumbres Observatory Global Telescope) explained how a global network of telescopes, LCOGTnet, can monitor a variable star around the clock. These telescopes are equipped with high speed EMCCD cameras which could make them useful for double star speckle interferometry.

Bobby Johnson, an Arroyo Grande High School student taking a double star astronomy research seminar at Cuesta College, was, at 16 years old, easily the youngest speaker at the conference. Bobby described his team's lucky imaging of the double star 69 And.

Looking toward the future, Elliott Horch explained how, at Lowell Observatory, he was revisiting (with modern detectors and electronics) the stellar intensity interferometry technique first developed by Hanbury Brown at the Narrabri Observatory in Australia. Since intensity interferometers only require "light bucket" telescopes of low optical quality, Russ Genet described portable "light bucket" telescopes he is developing with engineering students at California Polytechnic State University. Intensity interferometry experiments with these telescopes are being planned. The final panel on advanced techniques was moderated by Gerard van Belle.



Figure 14: Hanbury Brown's stellar intensity interferometer in Narrabri, Australia (left). On the right is the portable 1.5 meter light bucket telescope designed and built by Russ Genet and students at California Polytechnic State University.

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Figure 15: Tables at the Aloha Dinner. The wine and food were both excellent, as were the spirited conversations.

The final session on intensity interferometry and light bucket telescopes was attended by Joe Ritter and inspired his conception of an array of large-aperture space light bucket telescopes. Joe, Elliott Horch, Gerard van Belle, and Russ Genet had an animated discussion of this concept in the parking lot in front of Tante's Island Cuisine just before the Aloha dinner. Within three days, the four of them had prepared an exploratory study proposal for this nano-arc-second system that Joe sent off to NASA.

The conference concluded with an Aloha dinner, conference memory slides shown by the conference's Master of Ceremonies, Jo Johnson, and an award ceremony.

The award ceremony at the conference recognized William I. Hartkopf's lifetime of double star research and service to the double star community. Bill was presented with a laser-enscribed Hawaiian koa wood paddle for his "Three Decades of Research and Service."



Figure 16: Steve McGaughey (left), besides being an accomplished visual double star observer and ship Captain, is both a visual artist (paintings) and musician. Yury Balega (right), who received a box of Hawaiian chocolate-covered macadamia nuts in recognition of his long journey from Russia to Hawaii, is also a musician. As a young student he earned his way through graduate school playing his guitar and singing Beatles songs.

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Figure 17: Harold McAlister (left), Director of the Center for High Angular Resolution Astronomy (CHARA), Georgia State University, and Director, Mt. Wilson Observatory, and Brian Mason, U. S. Naval Observatory, Astrometry Division, and President of the International Astronomical Union's Commission 26 on Double and Multiple stars. They provided the testimonials for Bill Hartkopf's award.

Although they could not be there in person, Hal McAlister and Brian Mason provided the testimonials to Bill's decades of research and service:

[From Harold McAlister]

I was delighted to learn that you are honoring Bill Hartkopf on Maui this weekend. He certainly deserves recognition for all he's done over the years, and continues to do, to advance the field of binary star studies.

The best thing I ever did was way back in 1981 when I invited Bill, who was then just finishing his PhD at Illinois, to join me at Georgia State in carrying out a long-term program of binary star speckle interferometry I'd started six years before as a post-doc at Kitt Peak. Over the next 18 years, Bill and I spent countless nights at the KPNO 4-m telescope, the Perkins Telescope at Lowell Observatory, and at whatever large telescope on which we could beg, borrow, or steal time to watch our many friends among the binaries do their slow orbital dances. In the process, we discovered a fair number of new systems, published dozens of orbits, measured new masses, honed the speckle reduction methodology to excellent precision and accuracy, compiled catalogs, and generally had a whale of a good time. I like to think that those efforts paid off by enabling speckle techniques to succeed visual micrometry as *the* method for observing visual binaries. As I look back now, those really were the golden years of my career, and Bill's diligence, persistence, attention to detail, devotion to the cause, and all-around good camaraderie were basically what made them so special. During those years, midway through which Bill became the de facto manager of our speckle program as I wandered off mostly into long-baseline interferometry, we wrote more than 50 papers together and amassed a very large collection of fundamental data for binaries. Our partnership held the record in the field for a number of years, but I'm sure that has now been surpassed by Bill and Brian Mason at the USNO. It is also clear that the productivity of our speckle efforts gave us the scientific credibility underlying the NSF support for what would become the CHARA Array. And, Bill played a very major role in our achieving that credibility.

It was quite a blow when Bill decided to move to Washington in 1999, but that hasn't stopped our collaboration, and Bill and Deborah remain dear friends to Susan and me. We see them from time to time, although not often enough. What I miss on a day-to-day basis, though, is Bill's excellent companionship, his great sense of humor—he's a world-class punster—and his overall joy in a job well done.

I wish I could have been there to offer my congratulations in person to you, Bill, and to hear your response that I bet includes a pun or two. No doubt our paths will cross again soon. In the meantime, keep an eye on all our old double star buddies up there in the sky.

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[From Brian Mason]

I have been delighted to work with Bill Hartkopf on a regular basis since 1991. Except for a brief hiatus when I preceded him to the Naval Observatory, we have spent a good bit of each day in each other's company, and in that I think I have gotten the better end of the stick. We have observed together for a total of a month each at Cerro Tololo and Kitt Peak on the 4m telescopes, for a week on the CFHT an island hop away right now, a few nights at NOFS on the 61", and a month and a half on the Hooker 100" on Mt Wilson. In addition to the many nights observing together, lately we have spent several weeks together completing 360 miles on the Appalachian Trail. Indeed we spend so much time in each other's company, that were it not for each other being happily married, people would talk!

He is my colleague, my collaborator, and I am glad to say, my good friend.



Figure 18: Deborah Cline (Hartkopf), Bill Hartkopf, Russ Genet, and the engraved koa wood Hawaiian paddle award.



Figure 19: Bill Hartkopf (left) and Russ Genet (right) square off with Hawaiian koa wood paddle versus Russian ceremonial mace (the mace was kindly contributed by Oleg Malkov to help keep the conference running on time and in good order). It worked! Not to be outshined by their husbands, Deborah Cline (Hartkopf) and Cheryl Genet (right) pose for a picture.

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The life of a double star astronomer isn't easy, filled as it is with long runs from scenic mountaintops around the planet, not to mention enduring wine and seven course dinners at international astronomical conferences. It's a tough job, but someone has to do it! Bill stepped up to the plate.



Figure 20: Bill's early speckle career included runs at the 4-meter telescope at Kitt Peak National Observatory. Data was logged on an early Osborne microcomputer. The speckle interferometry camera was installed at the Cassegrain focus. That's Bill in the "Cass cage."

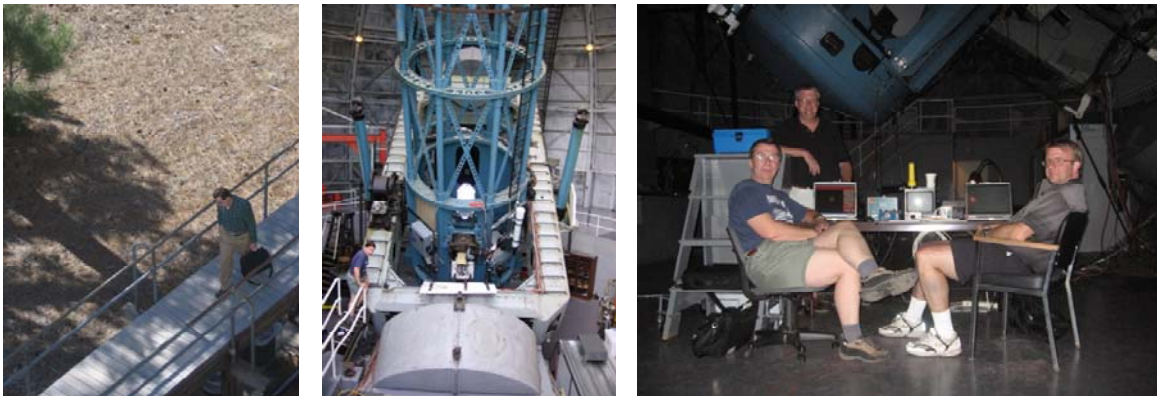


Figure 21: Many of Bill's speckle runs were made at the historic Hooker 100 inch telescope on Mt. Wilson. Bill heads for work on the same boardwalk used by Edwin Hubble and Milton Humason on their way to work, not to mention Albert Einstein during his visit to Mt. Wilson. Bill (left), Hal McAlister (rear), and Brian Mason (right) speckle away under the 100 inch telescope. The real fun, however, was installing the calibration slit mask at the top of the telescope!



Figure 22: Attending the tri-annual General Assemblies of the International Astronomical Union was an important duty. Bill served a term as President of IAU Commission 26, Double and Multiple Stars. Did Bill, at the 2006 IAU General Assembly in Prague, vote for the demotion of Pluto? Brian Mason, José Doboco, and Bill Hartkopf in front of the Ramón M^Á. Aller Astronomical Observatory in Santiago de Compostella, the capital of the autonomous community of Galicia in Spain, which hosted a double star conference replete with a fine dinner.

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The Maui International Double Star Conference was thoroughly enjoyed by all its participants. The exchanges between professionals and amateurs, educators and students, were informative and cordial. Maui's "aloha spirit" imbued the conference with a relaxed, friendly demeanor.

The need for an international organization that would, worldwide, link professional, amateur, and student double star researchers together was discussed repeatedly in the panels and over drinks and meals. As a result, the International Association of Double Star Observers (IADSO) has been formed—an informal organization that has adopted its founding conference's "aloha spirit" of friendly informality and open communications. All those interested in double star observations are invited to join the IADSO as a charter member.

One good conference deserves another, and another, and ... Already rumors are circulating about an August 2014 conference in Europe, a June 2015 conference at the Lowell Observatory in Flagstaff, Arizona, and a conference at the 6 meter telescope of the Special Astrophysical Observatory in the Zelenchuksky District on the north side of the Caucasus Mountains in southern Russia. Stay tuned!