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Society of Amateur Radio Astronomers – A membership supported, non profit [501 (c) (3)] Educational and Radio Astronomy Research Organization

Publishing in Radio Astronomy -

Anyone wishing to submit an article or material of interest, should submit the following:

- Microsoft Word on Disk, ZipDisk or by email. ***For large files not friendly to downloading, please use the US or International mail system.***
- JPEGS in high contrast Black and White or color.

Send your submissions for publication to:

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Letter from the President
Tom Crowley

SARA'a 20th Anniversary Conference at NRAO Greenbank, WV is now in the history books. Charles Osborne, SARA VP did an outstanding job of bringing together a number of excellent speakers for the conference. Check WWW.PARI.EDU for a list of speakers and topics covered. Everyone who attended thought it was one of the best conferences ever. Jeff Lichtman, SARA founder gave a short history of SARA. Monday evening, a 20th Anniversary cake and Champagne party was held in the Drake lounge.

SARA Members at NRAO (SARA 20th Anniversary) July 16, 2001
(Photo by Dr. H. Paul Shuch)

The 2001 SARA elections were held and the attending membership voted in the following:

Vice President:	Charles Osborne
Secretary:	Hal Braschwitz
Treasurer:	Janus Osborne
Director:	Dr. H. Paul Shuch
Director:	Jim Van Prooyen
Director:	Carl Lyster
Director at Large:	Rein Smit

Many thanks for their distinguished service on SARA's Board over the years: Vince Caracci SARA Secretary, Kerry Smith as Director and Hal Braschwitz as Treasurer. Hal received the *2001 SARA Presidents Award* for outstanding service to SARA. Hal stepped in and resolved the Treasurer issues.

SARA Founder, Jeff Lichtman has picked up the job as the SARA Journal editor from Chuck Forster. Chuck has served SARA as editor for the past five years. Chuck will continue to support SARA as a Director and is also starting a new Radio Astronomy web page. Chuck will provide information on the web site in a future Journal
Your SARA board is looking for ways to improve both the Journal and web pages for the membership. If you have any thoughts or comments please let me know. We are also looking to provide a regional meeting, perhaps in the spring. If you are interested in helping host a one-day SARA meeting, please let me know.

A Note from the Founder
Jeffrey M. Lichtman

On our 20th Anniversary, I am very proud to say that all of us have accomplished a real milestone!

When SARA was started in 1981, I could not have imagined that it would grow to an International organization. In fact, I don't believe I even gave longevity a real thought!

Prior to SARA, I served as the Radio Astronomy Chairman for the IUAA (International Union of Amateur Radio Astronomers). The time it took to conduct business with the UK organization (pre-email) due to the locality and time for direction, approval and answers became very time consuming. It was at one of those times, the thought of a locally based radio astronomy group was perceived. I put a note in Sky and Telescope asking for all interested people to contact me. It was the wonderful to receive letters and phone calls from those interested in Radio Astronomy. SARA was born!

Our first officers were; Jeffrey M. Lichtman (Founder and President), Lt. Col. Robert (Bob) Patterson, Jack Chancellor, Secretary/Editor and Robert Baker, Treasurer.

Thinking of SARA as one would a child, you nurture and advise the child, give direction and hope that all will turn out right as they venture forward. As time goes along, that child learns and produces great things. As time furthers, the child becomes very knowledgeable and then teaches the parent on all the new and wonderful things they have learned! That is what has happened! When I started in the area of amateur radio astronomy (1964), I asked many questions of my then mentor, Bill Maggio. When SARA was started, people came to me, Lt. Col Bob Patterson and, Bob Sickels wanting information and guidance. As the organization grew, so did the knowledge of the members. Now, 20 years later, I just sit and listen. The members of SARA have grown wise and sharp in the area of radio astronomy. I'm very proud of you all!

Over the past 20 years, we have had some wonderful people join with us. Robert (Bob) M. Sickels, a real pioneer in the field of amateur radio astronomy, C. W. De Villiers of Hermanus, South Africa, and John Francis of Geelong, Victoria, Australia, (who have now passed on). These people and others were very significant in furthering SARA and radio astronomy.

At our recent 20th Anniversary conference at NRAO (July 15 – 18, 2001), we saw many new faces and heard their hopes for SARA. We listened to the lectures and papers from new and existing members. We learned and gave guidance to those finding their way. Dr. Gordon Holman of NASA Goddard Astronomy and Astrophysicist (Solar Physics) gave us a wonderful lecture on the new HESSI satellite, which will study the sun.

Some members worked at the 40 footer (1.4 GHz) and successfully captured radio sources. Next year, we are planning to do a Mentor Certification for all those interested in operating the 40 foot system. More to come on this!

Again, I would like to welcome all the new faces and members into the SARA family. Also, our new Board of Directors. Thank you all for making SARA a winning organization!

AND, our Gratitude to Mike Holstein, Becky Warner, Sue Ann Heatherly, Staff, and the ladies in the cafeteria (at NRAO, Green Bank), who make it all possible!

A Post Observation Pulsar Detection Algorithm

by
James H. Van Prooyen

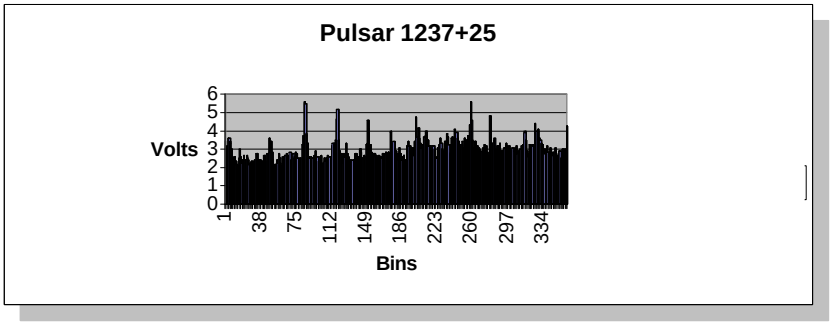
(Presented at the SARA Conference (NRAO) 7/16/01

Introduction

Detection of pulsars has been an area of study where large radio telescopes have generally dominated. This is due to a number of factors, such as the amount of gain required (and therefor antenna size) to study an object with a flux-density of only a few tenths of a Jansky. Amateur pulsar detection systems have been built using a hardware approach. This paper that idea and does via software.

Status

The coding and testing of the algorithm is complete. Initial testing was done with a hand coded data file with data which replicated a pulsar with all the data in the least significant digits of the file. Testing on known pulsars has started with the observation of Pulsar 1237+25, and processing of the observation files using the algorithm and plotting of the data using Microsoft Excel. Below is the first data plot of Pulsar 1237+25.



Each Bin is 1/10 of a second.

Post Observation Pulsar Detection Algorithm

The pulsar detector works in the following manor. We sample the signal using a time base that is some integral fraction of the period. Each sample taken during the duration of a single pulse period is assigned to a bin. The sample can then be folded back so those samples from corresponding bins are added together. Each time we add a new series of bin values for the ongoing totals, we "re-normalize" by subtracting an amount from all of the bins so that the weakest bin value is brought back to zero. Random noise in each bin tends to average out and bins with a slightly higher average, will gradually "grow" above the others. A picture then emerges. This shows how the average strength of the pulsar signal varies over its period.

Pulsar Detector Operation

To run the program start a DOS window and type “RA_PSR1”.

Known Problems

This is the first release of the program. Several bugs are listed below:

1. You must have the pulsar centered in your beam. I have collected a lot of data where the target pulsar was not centered in the beam. Processed the data and found nothing. With the pulsar centered in the beam of my radio telescope I have detected several pulsars.
2. The user interface is vary hard to use, I hope to have this fixed on the next version of the program.
3. The input format may not be compatible with your data collection system.
4. This is an area that needs major work but I need to find all of the possible file formats that need to be supported.
5. There may be lot of numerical error in the program.
6. Post processing detection is a lot of work, I hope to have a near real time version of the program that can run in the background. This is next years project.

Source Code

The source code is in "Turbo Basic". You will find a large number of comments in the code so it can be converted to any other language without any great deal of problems. Anyone is welcome to copy the source code (grro@home.com) and use it for scientific or educational purposes. Commercial users please contact the author. If you use this source code please send an e-mail to the author so, your name can be placed on an update list. Version RA_PSR1.BAS has a very complex user interface the next version will address this problem with a more friendly user interface.

Note: Due to the size of the source code, it will not be printed in this Journal. For further information, please contact the author at: grro@home.com

Editors Note: Jim Van Prooyen is the Software Chairman for SARA. He may be reached at : grro@home.com.

Solar Radio Observing with the AAVSO's Gyrator II Radio
by
Jon Wallace

Solar Flares & Prominences

Sunspots are areas of lower temperature but high activity on the sun. These are caused by the looping and shearing of the magnetic field lines due to the sun's differential rotational speeds (i.e.: equator rotates faster than poles). Many times, flares and prominences (loop-like structures - see picture on right) are associated with these sunspots.

Solar Flares and the Ionosphere

Solar Flares are a tremendous explosive burst of light and material from the sun. A flare gives off as much energy as the earth consumes in 100,000 years. This energy can effect the Ionosphere, changing the height of the D, E and F layers and affects communications,
etc.

Sudden Ionospheric Disturbances (SIDs)

The flare-induced changes in the Ionosphere can be detected using various radio frequencies. The AAVSO has chosen to use VLF. I use the 24.0 KHz signal from Cutler, Maine.

The AAVSO Radio & Antenna

Check out the AAVSO site for all the relevant information and schematics:

http://www.aavso.org/committees/solar/equipment.stm

Far Circuits sells a circuit board for this project for about $7 (details on the site). It makes it a lot easier to build the project. Most parts are available from Radio Shack or Mouser Electronics. I used a ten-turn potentiometer for the tuning so I can get better control. The antenna is easy to make but consists of 125-200 turns of wire!

Detected flares are generally caused by X-ray flares and have various flux levels associated with them (see chart on next page). The radio detection records a peak (or a trough as in my case) when a flare is detected (see charts on the next pages).

To join the AAVSO Solar Radio group simply register on-line. You are given a number and a program to use to facilitate sending the data the group leader and the data is made into a monthly chart. Charts and other solar data for the month are available from:

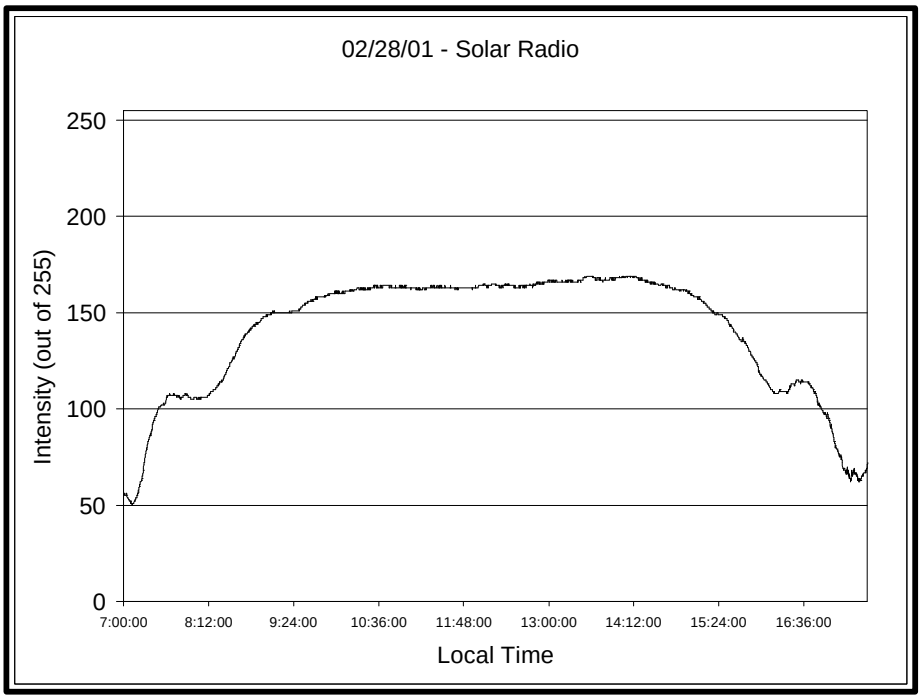
http://www.aavso.org/committees/solar/bulletin.stm

Please feel free to contact me for more information, questions, or comments

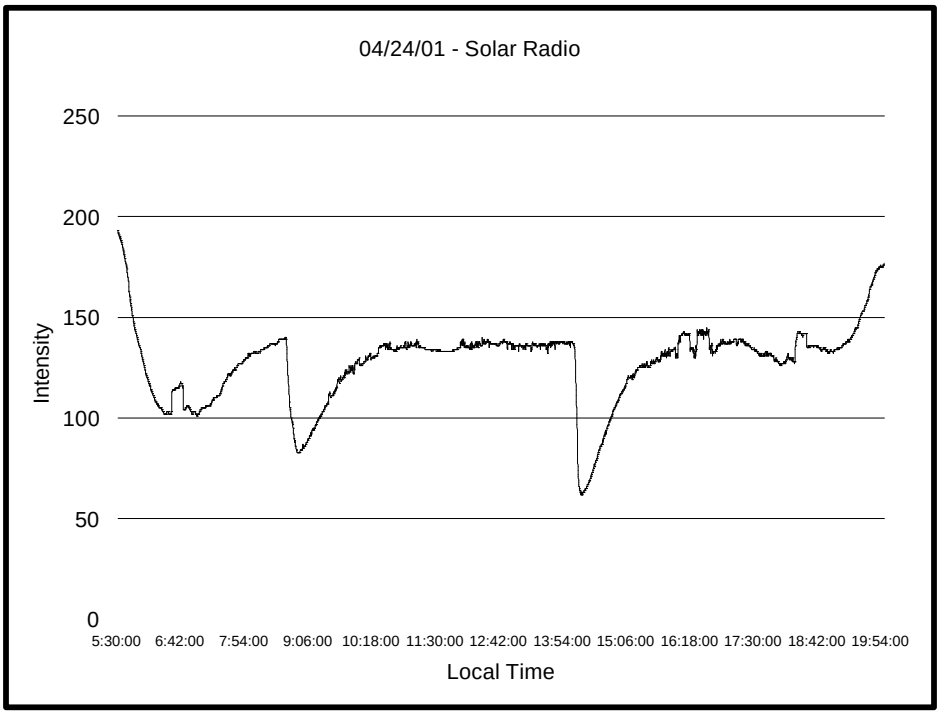
Jon Wallace
111Birden St., Torrington, CT 06790
fjwallace@snet.net

X-ray Class	x = peak flux in the 0.1 to 0.8 nm range	
	In mks system	In cgs system
X-ray Class	Wm-2	cm-2 s-1
A	< x 10-7	x 10-4
B	10-7 <= x 10-6	10-4 <= x 10-3
C	10-6 <= x 10-6	10-3 <= x 10-2
M	10-5 <= x 10-6	10-2 <= x 10-1
X	10-4 <= x	10-1 <= x

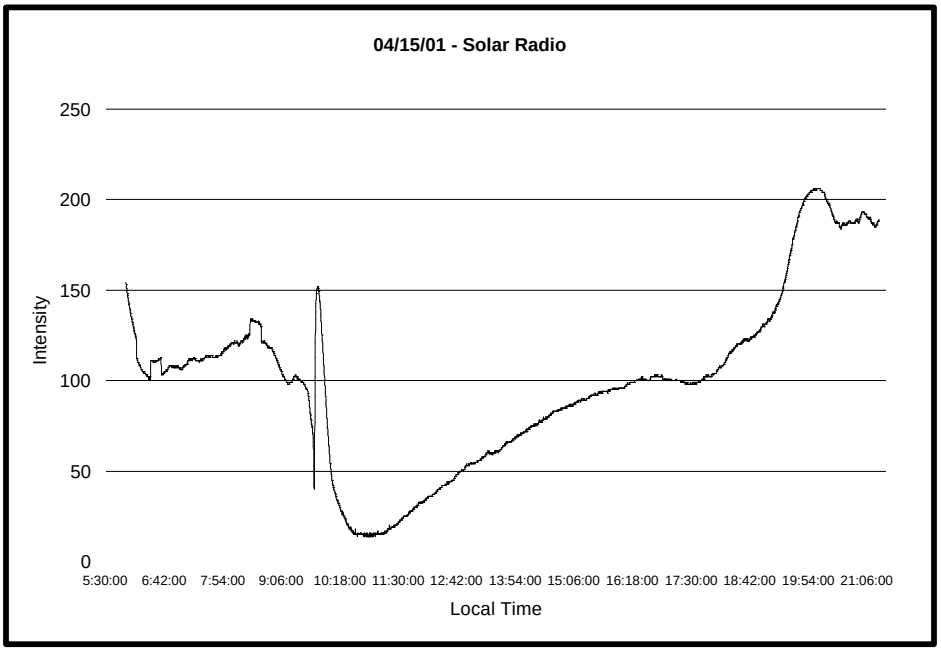
Integrated flux from start to end, in joules m E-2.



A quiet day with no flares present. Note the peaks on both ends - called the sunrise effect.



A day with several large flares. Flares usually appear as upward peaks - on my receiver they appear as downward troughs.These are M1.6 & M2.3 flares (respectively



A day with an amazing X 14.4 flare!

SARA Member Profile

Jim Van Prooyen

SARA member, Jim Van Prooyen is a 47 year old, Software Engineer (working on the A300 Airbus systems) from Grand Rapids, Michigan.

Jim has been active in Radio for several years and is currently doing observational work in the 408 Mhz band, and developing software to detect pulsars with small radio telescopes.

Jim is involved in a new endeavor called "The Radio Astronomy Consortium (RAC)". This group will be involved in harvesting antenna systems and working with educational institutions, to establish Radio Astronomy Programs. Teamed with low noise radio telescopes and the latest computer technology, this program will be a real boost to the field of Radio Astronomy education. Currently in the process seeking funding from the National Science Foundation (NSF) to convert these antennas into Radio Telescopes

To contact Jim Van Prooyen please send e-mail to grro@home.com

Jim Van Prooyens 3 Meter Antenna

(The Journal will feature a SARA Member Profile, in all upcoming issues)

Radio Astronomy News

Editors Note: This feature contains past and present news information.

Upcoming NRAO (Green Bank 2001 Events)

- July 21 - 27 Hands-on-Universe Workshop Auditorium
- July 28 NRAO GB Annual Picnic Recreation Area
- July 29 - August 11 RARECATS Auditorium
- September 12 Training GB Middle School, RESA IV Auditorium
- September 13 - 14 Education & Public Outreach Roundtable Auditorium September 19 Training PCHS, RESA IV Auditorium
- October 26 Jansky Lecture Auditorium

NRAO's A Short History of the Forty Foot Radio Telescope

The Forty-foot Telescope, was constructed in the early 60's for the purpose of determining if radio sources are variable. As far as we know, it was the first completely automated telescope. After sitting idle for nearly 2 decades, the 40' was recommissioned in 1987 as an educational telescope. Students ranging from 5th graders to graduate students use the telescope to investigate the radio universe. Teachers participating in our summer programs complete extensive research projects using the 40', and Chautauqua Short Course participants have access as well. In addition, amateur astronomers routinely make use of this telescope.

Green Bank Workshop --- 21 cm HI Survey Of The Milky Way

The Green Bank Workshop on the topic of 21cm HI Surveys of the Milky Way that was held from May 21-23, 2001 at the National Radio Astronomy Observatory in Green Bank WV, USA, to celebrate the 50th anniversary of the discovery of the interstellar 21cm HI line. The Workshop will be the first science gathering of the International Galactic Plane Survey project, which will combine high resolution HI surveys of the Galaxy underway at the DRAO, the ATNF and the VLA. The Workshop will bring together researchers who are involved in these and other HI surveys, and related surveys of the Milky Way, to share techniques, results, and prospects for the future. The Observatory at Green Bank is a particularly appropriate site for this Workshop, as it is home to the original Ewen-Purcell horn and the new 100 meter Green Bank Telescope, which will be in operation at the time of the Workshop.

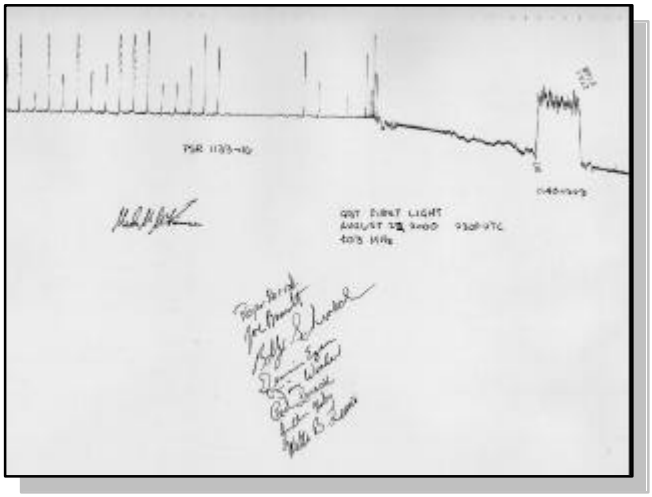
"First Light" for the Newly Christened Robert C. Byrd Green Bank Telescope

Strip Chart Recording of the Pulsar Signals Received During the Robert C. Byrd Green Bank Telescope's First Observation of a Celestial Radio Source.

First light details:

The Robert C. Byrd Green Bank Telescope saw 'first light' (that is, detected its first radio waves from space) at 7:00 p.m. EDT, Tuesday, August 22, 2000. Earlier that day, a 403-megahertz radio-wave receiver had been installed on the telescope.

In its first simple observation, the GBT tracked a radio galaxy called 1140+223 across the sky. The telescope then locked onto a pulsar called PSR B1133+16 and a chart recorder scratched out the regular pattern of its radio pulses, which reach Earth every 1 2 seconds. (A pulsar is a rotating neutron star that shines a beam of radio waves like a cosmic lighthouse; these radio pulses sweep across the Earth at regular intervals.) Dr. Mark McKinnon, Deputy Site Director at NRAO's Green Bank site, led the team that conducted the observations.



For further information on the GBT, or to download high-resolution images of the telescope, please visit the GBT Dedication Homepage.

The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc.

VLA Soccorro - March 14, 2001

Students Use VLA to Make Startling Brown-Dwarf Discovery

A group of summer students making a long-shot astronomical gamble with the National Science Foundation's (NSF) Very Large Array (VLA) have found the first radio emission ever detected from a brown dwarf, an enigmatic object that is neither a star nor a planet, but something in between. Their surprising discovery is forcing experts to re-think their theories about how brown dwarfs work.

"Many astronomers are surprised at this discovery, because they didn't expect such strong radio emission from this object," said Shri Kulkarni, a Caltech professor who was on the team that first discovered a brown dwarf in 1995, and advisor to one of the students.

"What is so cool is that this is research that probably nobody else would have tried to do because of its low chance of success. That made it ideal for summer students -- we had almost nothing to lose," said Kate Becker, a student at Oberlin College in Ohio.

"The radio emission these students discovered coming from this brown dwarf is 10,000 times stronger than anyone expected," said Dale Frail, an astronomer at the National Radio Astronomy Observatory (NRAO) in Socorro, NM. "This student project is going to open up a whole new area of research for the VLA," Frail added.

The students, in addition to Becker, are: Edo Berger from Caltech; Steven Ball from New Mexico Tech in Socorro, NM; Melanie Clarke from Carleton College in Northfield, MN; Therese Fukuda from the University of Denver; Ian Hoffman from the University of New Mexico in Albuquerque; Richard Mellon from The Pennsylvania State University; Emmanuel Momjian from the University of Kentucky; Nathanial Murphy from Amherst College in Amherst, MA; Stacey Teng from the University of Maryland; Timothy Woodruff from Southwestern University in Georgetown, TX; Ashley Zauderer from Agnes Scott College in Decatur, GA; and Robert Zavala from New Mexico State University in Las Cruces, NM. Frail also is an author of the research paper, published in the March 15 edition of the scientific journal *Nature*.

Berger, Hoffman, Momjian and Murphy are graduate students, and the rest were participants in the NSF-funded Research Experiences for Undergraduates program.

The 14 students spent last summer working with NRAO scientists in Socorro. While each student had their own scientist-mentor, the VLA summer students also traditionally receive some VLA observing time for a collaborative project of their own. They sought ideas for their project from the NRAO staff, and, when they asked Frail, he suggested that they look at the latest research result from the recently-launched Chandra X-ray satellite.

The students went to the Chandra World Wide Web site, and found that the satellite had detected an X-ray flare from the brown dwarf LP944-20. "We did some background reading, and realized that, based on predictions, the brown dwarf would be unobservable with the VLA, but we decided to try it anyway," said Berger.

"Everybody we talked to said there was almost no chance that we'd see anything at all," said Becker. "They added, though, that it would be really exciting if we did," she said.

The students had been given three hours of VLA observing time for their project. They used an hour and a half of it on the brown dwarf.

The day after their observation, the students gathered at the NRAO Array Operations Center in Socorro to process their data and make their images. Berger, who had experience processing VLA data, worked alone in the same room as the other students, who were working together on another computer. Berger finished first and was shocked at his image.

"I saw a bright object at the exact position of the brown dwarf, and was pretty sure I had made a mistake," Berger said. He waited for the others, who were working under the guidance of another NRAO astronomer. Ten minutes later, their image appeared on the screen, also showing the bright object at the brown dwarf's location.

"We all got excited," said Berger, who then began breaking the hour and a half's worth of data up into smaller slices of time. This showed that the brown dwarf's radio emission had risen to a strong peak, then weakened. That meant that the star had undergone a flare. "Then we got real excited," Berger said. They immediately sought and received more observing time, ultimately capturing two more flares.

"They got very lucky," Frail said. "The thing flared during their observation. Other astronomers had looked for radio emission from brown dwarfs and not found any. This one flared at just the right time," Frail added.

"It was just an incredible fluke that we found it," said Becker. Brown dwarfs are too big to be planets but too small to be true stars, as they have too little mass to trigger hydrogen fusion reactions at their cores, the source of the energy output in larger stars. With roughly 15 to 80 times the mass of Jupiter, the largest planet in our Solar System, brown dwarfs had long been thought to exist. Actually finding them, however, proved difficult. After decades of searching, astronomers found the first brown dwarf in 1995, and a few dozen now are known.

The strong radio emission was unexpected because brown dwarfs, according to conventional theories, are not supposed to have magnetic fields strong enough to generate the radio emission. "The presumed internal structure of a brown dwarf will not permit a strong enough magnetic field," said Frail. "It looks like we're going to have to re-examine how we believe brown dwarfs work," he said.

"The mere fact that they detected radio emission is remarkable," said Tim Bastian, an astronomer at the NRAO in Charlottesville, Virginia, who added that this object "will likely have something to teach us."

"We're going to have to study this and other brown dwarfs more extensively with the VLA to answer the questions raised by our summer students' discovery," Frail said.

The National Radio Astronomy Observatory is a facility of the National Science Foundation, operated under cooperative agreement by Associated Universities, Inc.

Contact:
Dave Finley, Public Information Officer
(505) 835-7302
dfinley@nrao.edu

Also, special thanks to NRAO Staff member, Shirley Curry (Green Bank Updates etc.)

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Knowledge through Common Research, Education, and Mentoring

Membership Application and Renewal Form

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If you wish, please include on an additional sheet your fax number, e-mail address, ham callsign, and information about your radio astronomy interests and equipment, and computers. Please complete a copy of this form and send it to the treasurer along with your money order or check. (Non-U.S. members: Please send an international money order or a check written on a U.S. bank in U.S. dollars.) Make al I checks and money orders out to "SARA." The mailing address is:

Janis Osborne
105 Reynolds Wood Dr.
Brevard, NC 28712-7245

Dues are $24.00 (U.S.), $30.00 (Canada and Mexico), and $36.00 (other foreign). Included with your membership is a subscription to *Radio Astronomy*, the journal of the Society of Amateur Radio Astronomers. Members who choose to receive an electronic copy of the joumal, receive a reduced dues fee of - $20.00 (U.S.).

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