TAOSON	
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I. Welcome

Welcome to the **Tamke-Allan Observatory Solar Observation Network. TAOSON** was conceived in 2007 and operated for its first year as a student group at TAO with members Tyler Moore, Heather Fries and David Fields. In 2008 we opened up the group to the larger local amateur radio astronomy community.

The primary purpose of TAOSON is to keep local radio astronomers in touch and help coordinate their activities as they maintain their radio astronomy research sites. To this end we maintain a server for storing and sharing data, schedule two meetings per month, and assist each other when needed. Most members support the Society of Amateur Radio Astronomers (see www.radio-astronomy.org).

TAOSON participates in the TAO Academic Associates of colleges and universities where members share research and scientific goals. This is both science and a humanistic endeavor that encourages cultural exchange. TAOSON also helps advise the TAO Space Explorer Groups with a common goal of developing capable and motivated human beings that will serve the community and become future scientists and contributors to a better world.

Membership is free if you're actively doing radio astronomy. Otherwise, membership is still free and you are invited to help with our projects.

II. Meetings

TAOSON

Regular monthly meetings are held on the 2rd Sunday afternoon (2 PM at SkyNet) of the month. Special meetings will be called as the need arises. The Oct. 12 meeting scheduled at SkyNet, has been cancelled due to Bill and Melinda's travel (for 2 weekends).

Meeting format will usually include a brief tutorial on a radio astronomy topic of interest, a work session on some chosen task or topic, a meal or refreshments, and a brainstorming session about projects.

TAOSON people are invited to the Orionid Meteor watch at TAO on October 22 (backup day on October 23). The usual frequency is 30 meteors/ hr.

Area Optical Astronomy Groups

Oak Ridge Isochronous Observation Network (Orion) meets at 7:00 P.M. on the first day of each month The Club Room, Oak Ridge Civic Center. See <u>www.roanestate.edu/obs</u> and www.orioninc.org

Barnard Astronomical Society (BAS) meets at 7:00 P.M. on the second Thursday of each month at the UT Chattanooga Clarence Jones Observatory. See BAS@chattanooga.net.

III. The TAOSON Signal

Our newsletter, the TAOSON Signal, will be published on or near the on the first day of each month. Every effort will be made to protect the e-mail addresses on the distribution list and the privacy of their owners. Feel free to circulate and share copies of the Signal.

Items for the newsletter will be submitted by email to Editor Bill Seymour at swafseymo@bellsouth.net and to David Fields at <u>fieldsde@aol.com</u>, not later than ten days prior to the next publication date. We encourage each active member to submit a paragraph that summarizes site activities, goals and ideas. Members are also invited to submit questions to the Editor to be considered in the newsletter and at meetings.

IV. Research Site Locations and Capabilities

TAOSON sites include those shown on the following map and identified in the following table.

Site locations and primary capabilities are as follows:

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TAOSON FACILITIES DIRECTORY

	Site Location		Site Name	Cede	Control Operator	Lat./Long.	Telephone	Operations
	Rockwood (Ð	TAO	TAO	David Fields	35.8322/ 84.6175	865- 376-1362	21cm, 15m, optical, Ku, Spectrocyber, Interferometer
	Cjeveland (2	Skynet	SN	Bill and Melinda		423 - 478-90 43	21cm, 15m, optical, Ku, Spectrocyber, VLF
	Solway 🤇	3	Solway	SOL	David Fields	35.9641/ 84.2021	865- 927-5155	15m, Ku, optical H-alpha VLF
	Chattanooga	T	Riverbend	RB	Dick Castle		423- 870-4398	15m
	Knoxville 🕧	3	Blue Meadow	BLM	Linia Fipin		865- 539-6826	VLF
	Niota 🔇	う	Niota	CL	John Mannone		423- 337-2197	Ku, optical, VLF
	Hixson	Ì	Big Ridge	BR.	Bill Seymour		423- 870-8552	15m, Ku, optical VLF
	Lenoir City (9 (7)	Lenoir City	ĻC	Aaron Haun		865- 986-7153	Server
	Karns 1	10		KA	Carl Lyster		Spectra	Cyber, VLF
Jc	hnson City	11		JC	Heather Fries		Quantitativ	e Optical, SID planned
	Puerto Rico)		PR	Wanda Diaz		Spec	trocyber, 15m
	UNAM, MX	Κ		UN	Stan Kurtz	SRT, Ho	omebrew IB	T, SpectraCyber, 15m

V. Basic Research Activities at Tamke-Allan Observatory

See <u>www.roanestate.edu/obs</u>. Free Public Skygazes are conducted on the 1^{st} and 3^{rd} Saturday evenings of each months and TAOSON members are invited. TAOSON meeting is held on the second Sunday of the month.

TAO is our primary meeting and workshop site. Capabilities include SpectraCyber, Jove system, IBT, Ku interferometer, and meteor bounce, plus some optical stuff that includes an 8" refractor, 12" reflector scopes, Sky Scout and spectrometers. SpectraCyber was built by Carl Lyster and used by Heather Fries last year for mapping.

The Ku band interferometer has also been used recently for mapping – this plot shows (left) the Ku emission from the sun and a near Clarke Belt satellite. Meteors are enjoyed by trying to detect the reflection of FM radio signals from their ionized tails. The photo on the (right) shows the pretty night sky during the Perseid shower at 4 AM on August 12.





VI. TAOSON Projects

Radio Jove

Dick Castle, Jove Coordinator, K2IMH

Tom Crowley

Welcome to the Radio Jove portion of the newsletter. Radio Jove is a NASA sponsored project to monitor the Sun and Jupiter at 20.1 MHz. It is teaching tool for radio astronomy for middle /high school, college students, amateurs and research groups. You build your own receiver and dual dipole antenna. Radio Jove web site is: **radiojove.gsfc.nasa.gov.**

The TAOSON group presently has 3 systems on-line with another being built. Sites are:

- 1. Harriman, TN Tamke Allen Observatory- David Fields
- 2. Cleveland, TN Skynet -Bill and Melinda Lord
- 3. Chattanooga, TN- Riverbend- Dick Castle
- 4. Hixson, TN –Big Ridge; Being built-not operational yet- Bill Seymour

Our objective is to monitor the Sun/Jupiter and see how the ionosphere affects the signals in different locations in close proximity. Data will be collected via Skypipe and sent to a server to be stored for analyses. TAO and Riverbend sites have been on-line since 2004. The Skynet Jove receiver has been recently built at Bill and Melinda Lord's with very high professional standards. Starting back in the fall last year they built a separate radio astronomy building next to their rolloff roof optical building. A dual dipole antenna was constructed and installed permanently. After that the Jove receiver was built and Skypipe software was installed on the computer. At this point we were ready to start collecting data. Early this spring we built Ten Tec 1056 receiver and then modified it for 20.1 MHz. We calibrated all three site receivers to Kelvin units on Skypipe using the Jove calibrator. A calibration procedure was also written. We have participated in four Radio Jove tele-conferences. These phone teleconferences bring together people from all over the world to discuss Sun/Jupiter events in real time. Presently we are in the process of building a portable dual dipole antenna system using fiberglass poles. The antenna system can be set up in less than 15 minutes and then be stored in a military bag for ease of carrying to outdoor events. As you can see we have been very busy and accomplished quite a lot in short span of time. We still have a lot to do and have only hit the tip of the iceberg. Next month I'll publish a list of outstanding projects we plan to accomplish in the next few months.

Itty Bitty Telescope (IBT)

[Several TAOSON members are members of the Society of Amateur Radio Astronomers (SARA) and take part in the SARA Navigator Project. Through this project, we have borrowed SARA IBTs, Ku band radio telescopes. Tom Crowley, SARA President and Navigator Coordinator, has agreed to be TAOSON project coordinator for our IBTs.]

SARA is developing a **new** Itty Bitty Radio Telescope (IBT) for the International Year of Astronomy (IYA) 2009. Initial tests have shown the new instrument is capable of a 90% meter deflection when looking at the Moon with an 18-inch dish. Now that's radio astronomy! We are planning on developing two versions, one will be able to do a level of real science and the other will cost much less and make a great intro or demo telescope.

So just what is an IBT you ask? It consists of a direct TV satellite dish and LNB, with the advent of High definition satellite broadcast many of these small dishes are being discarded. You or your neighbor may have a dish that's ready to be tossed, and may well do the "green" thing and recycle it to an IBT. You simply add a satellite detector from Ebay or Radio Shack or order a Channel Master 1040IFD tuning meter for under \$80 on the web, build a base and you are ready to go.

If you are interested in building your own IBT check out: http://www.aoc.nrao.edu/epo/teachers/ittybitty/procedure.html

Many SARA members have built IBT's and have had good success with them. SARA editor John Mannone has used an IBT to determine speed and Doppler shift of an automobile. All right -- not quite radio astronomy, but a unique experiment nonetheless.

For more information on the International Year of Astronomy check out: <u>http://astronomy2009.us</u>

VII. Reports from The Sites

SkyNet

Members of the Scenic City Amateur Radio Society (SCARS) of Chattanooga, Tennessee toured the SkyNet Observatory in Cleveland, Tennessee on August 2, 2008. SkyNet owners Bill and Melinda Lord started the evening by erecting a portable single-dipole antenna used for Radio Jove. Assisting the Lord's was Dick Castle who helped in building the antenna. The group looked at and discussed the permanent dual-dipole Radio Jove antenna and the Cband dish antenna used for detecting Hydrogen. The group squeezed into the radio astronomy observatory (it is only 8' by 12') and were shown the Radio Jove units, the TenTec receiver, SpectraCyber and the Sudden Ionospheric Disturbance (SID) receiver. A brief explanation of each unit was given along with the software used to collect data. Bill Seymour presented additional scientific detail of how the observations were accomplished.

Bill Lord demonstrated the capabilities of Itty Bitty Telescopes while connected to a two pen strip chart recorder. Using the IBT's he showed them where satellites were orbiting and how their body temp was detected and then displayed on the chart.

Later in the evening, the Lord's opened the visual observatory to allow the SCARS members to see Jupiter in the Meade LX55 8" telescope. Since most of the members stayed on to hear the possible Jupiter storm later that night, they enjoy seeing Jupiter and four of her moons. There

was discussion of how radio astronomy offers a great opportunity for observing even when skies are light polluted.

By 10:30 pm the group was back into the radio observatory where Lord and Castle had their two Radio Jove units set up. Lord's was on the dual-dipole and Castle's was connected to the single dipole. We hoped to compare the signal received by the two units with the different antennas. In addition, we brought up one client on each of the two computers so the group could see what other Radio Jove's were detecting.

We called in to the Jove telecom at 11:00 pm and listened to what others had to say about the observing that night. By the time the group left after midnight, we had some excited ham operators interested in learning more about this hobby.

Bill Seymour and Dick Castle are both SCARS members and are also Tamke-Allen Observatory Solar Observers Network (TAOSON) members along with Bill and Melinda Lord.





We've a new security system in the classroom and house, one of the best astronomy classes ever, and the start of a Jove dual dipole. The posts are up and set in concrete:

Plans are to dig trenches and add conduits next week, then to have a TAOSON work day week after next when we add the antennas and feed lines.

Another project is to have a Orionid Meteor watch at TAO on October 22, with a backup day of October 23. The usual frequency is 30 meteors/hr.

Solway

Solway has an operating GID (Global Ionospheric Detector) that records the 40 kHz terrestrial radio background. Since our 60m horizontal antenna was showing very large signal swings



on most days, we experimented with different antennas. On the left is an example of a 5 hour session on 9/11 that spans 5h. On the right is an example of a 30 hour session on 9/13 with a 30 m antenna. Large excursions correspond to periods of rain.

Clearly the 30 m antenna is the best match to the receiver sensitivity.

ETSU



Heather Fries sent these pictures of the cooled 14 inch telescope with ccd camera at the East Tennessee State University University where she is making variable star measurements. She also sent the following photo of the Andromeda Galaxy (M31) for our enjoyment.



VIII. MY JOURNEY IN RADIO ASTRONOMY Dick Castle

I was born in the Mohawk Valley in upstate New York- Ilion, N.Y.(home of Remington shotguns and/novels-Last of the Mohicans/Drums Along the Mohawk) on October 8,1941. I have always been interested in some form of radio. Back when I was about 10 years old I built my first crystal set radio and was amazed how you could hear radio signals with a coil of wire, germanium crystal and a headset. In 1957 I received my ham radio license-K2IMH and then in 1962 joined the Navy-Aviation Electronic Technician Second Class. Discharged from the Navy in 1966 went to work for Control Data Corporation (CDC) as a customer engineer at Griffiss Air Force Base Rome, N.Y. In 1978 moved to Chattanooga to work for Tennessee Valley Authority (TVA) at Sequoyah Training Center as a Simulator Hardware Maintenance Technician working on TVA's

nuclear power simulators. In 1994 went to work at the Nuclear Regulator Commission Training Center (NRC) in Chattanooga as a contractor-Pulau Electronics and Engineering Support Personnel (ESP). I retired last year and really enjoying it.

I got my first radio astronomy exposure back in November 20003 when David Fields held a SARA Southeastern Conference at Roane State Community College. Radio Jove was discussed and I have been hooked ever since. In 2004 I built the Radio Jove kit receiver and antenna at Riverbend observatory. In 2005 installed a dual dipole antenna at TAO in Harriman. I attended SARA conference at Green Bank in 2004-5. In 2007/08 helped Bill and Melinda Lord at Skynet to build a Radio Jove system. My primary interest is Radio Jove – monitoring Jupiter/Sun and am looking forward to broaden my experience with SID and Spectra-Cyber at Skynet.

On a personal note I have been married to my lovely wife Mary for 44 years. We have 2 sons and a daughter. All children are married with 3 wonderful grandchildren. My other interests areham radio-K2IMH-Extra Class(VE Examiner, WAC and DXCC awards), President of Chattanooga Old Time Radio Club, member of Scenic City Amateur Radio Club(SCARS) and enjoying fishing and camping.

Bill Seymour

Growing up in a small town in Virginia in the 1950's, I was first attracted to short wave radio by a family friend, a rural mail carrier, who had purchased a short wave radio receiver and listened avidly to the world from his home every night. Then, the next person who took me deeper into radio was the engineer of the local commercial radio station who invited young persons with a radio interest to hang around the transmitter building where he explained the inner workings of all of the equipment. The engineer encouraged several of us high school students to study for the novice ham radio exam. My first call in 1955 was KN4AOL, and I let it expire when I went away to college. (Looking back, I have often wished that I had kept such a phonetic combination.) However, what the engineer did not encourage was typical teenage risk-taking by me and my friends. So, without his knowledge, three of us climbed up the outside of an180 foot radio tower without safety harnesses one day when the transmitter was turned off. Needless to say, we survived to go on to college to instigate more pranks. At The University of Tennessee in Knoxville, I began to hang around the university ham radio station, W4ONO, in the electrical engineering building where I made a lot of friends and learned a lot more about ham radio. My general class ham license, with the call sign WA4WCO, soon followed. I began to feel pretty lucky that of all of the random combinations of letters in the alphabet, I received a second successive call with good phonetics. While starting my career as a nuclear research chemist on the University of Tennessee staff at Oak Ridge, getting married, and starting a family, I still found time for ham radio. At this point, my attention turned to DX, fueled by two hams who befriended me-the first was my wife's cousin who was a career diplomat in the Foreign Service and who kept in steady contact with me from exotic posts all over the world on many continents over the years. The second was a next door neighbor who was transferred to a permanent post at the United Nations Atomic Energy Agency in Vienna, Austria. He kept me connected with European DX networks for many decades. An advanced class license came many years later, and my string of good phonetic luck continued with the call sign KM4YL which I have retained to the present time. The turn to radio astronomy came in the 1990's when activities at the NRAO in Green Bank, the Very Large Array in New Mexico, Arecibo, and other locations were in the news and attracted my attention. I began to purchase books on the subject, and I was hooked!

An early purchase, <u>An Introduction to Radio Astronomy</u> by Burke and Graham-Smith is still my favorite. Needless to say, I was delighted when David Fields and John Mannone introduced me to the activities at TAO, and later to SARA. In the last year, it has been wonderful to be associated with Bill and Melinda Lord and Dick Castle who are building an outstanding home radio astronomy facility outside of Cleveland, TN where there is land space that few of us have at our residences. With their assistance, I will be setting up SID and Radio Jove in the very limited area at my house in the future. Long term, I am also interested in detecting cosmic radio bursts. Throughout my career, I have always had very strong writing skills, so it is now only natural to combine these with my technical interests as TAOSON Newsletter Editor, and as Associate Editor of THE SARA JOURNAL working under Senior Editor John Mannone.

David Fields

My interest in both radios and astronomy came early. It was curiosity about the night sky that led me to beg my parents for encyclopedias and to build my first telescope. Later I found that discarded radios and televisions were my source of parts for transmitters, receivers, amplifiers, analytical devices, etc. Using instruments that I built, I listened to solar noise and earth currents. I liked building new instruments and eventually got a job in an electronics lab, then with GE, then at Argonne NAT. Lab., then did some research with a phosphoremeter, NMR system, radiation detectors, X-ray machines and an oscillator that sensed magnetic fields, Both radios and astronomy still interested me, but I drifted away from building things and toward mathematical analysis and computer simulations.

After I found that CB radios didn't keep my field research group in close enough contact, Carl Lyster offered to help, and me convinced me to obtain some ham licences and later, to join SARA as member #75 (Thanks, Carl). That we can actually detect and analyze signals from Jupiter, Sol, and various features of our planet is thrilling, isn't it. That's radio astronomy! And, with radio astronomy, I am getting back to building things.



Anecdotal Biography of John C. Mannone

Figure 1: Parkes Radio Telescope

Teaching a two-semester college astronomy course (2000) prompted me to make an already interesting subject have greater appeal to the class. "Thinking outside the box" is necessary for any visionary goal; here, I was driven to develop a "world class" astronomy program among Community colleges. And radio astronomy factored profoundly into this vision.

Why radio astronomy? Remarkably, the overwhelming amount of what we now know about our universe has been revealed through radio astronomy. It developed since Karl Jansky's August 1931 discovery of radio waves from our Milky Way galaxy and Grote Reber's follow-up pioneering work during the next decade. Yet this aspect of astronomy is often omitted or given sparse treatment.

Two hauntingly beautiful images on radio astronomy captured my attention in the textbook I was using (*Universe*, 6th ed., Freedman). One appealed to my aesthetics, the other to my intellect. The first one was the Parkes radio telescope (Figure 1) on the Australian plains. The 64-ft parabolic antenna is poised cupping the setting sun blazing in its bowl. The other one is a comparative image of the M81 galaxy group in optical and radio (Figure 2). The radio image clearly shows the dynamics of galaxy collision with its telltale tidal tails. This one excited me very much, so I instigated further study.



Figure 2: M81 Group – Optical (left), 21 cm Radio (right)

Subsequent searches to about radio

internet learn more

astronomy quickly led me to NASA outreach programs—the INSPIRE (Interactive NASA Space Physics Ionosphere Radio Experiments) and Radio JOVE projects—as well as to the Society of Amateur Radio Astronomers (SARA). I was particularly enchanted by the Radio JOVE project, an inexpensive kit (direct conversion high frequency radio receiver (20.1 MHz) with a two-dipole phased array) to "listen" to solar flares and Jovian magnetic storms. I was nabbed by the "wow factor," but was hooked on the physics.

A flurry of activities was quickly set in motion. A Radio JOVE kit was ordered and its assembly coordinated with the electronic students in the Engineering Division, a sister division to Mathematics and Science where I taught. I acquired additional funding for faculty development and attended three radio astronomy education outreaches: *Radio Astronomy in the Undergraduate Classroom* (Chautauqua Conference, MIT Haystack Observatory, Westford, MA, May 2001), *A Radio View of the Universe and the New Green Bank Telescope* (Chautauqua Conference, NRAO, Green Bank, WV, May 2001), and *The Small Radio Telescope Workshop* (Pisgah Radio Astronomical Institute, Rosman, NC, August 2001). I recommend a little self-study of radio astronomy before conferences or workshops like these to help digest the

voluminous, but exciting, information. This prepared me well to include radio astronomy in my lassroom and get students excited about a field that had otherwise been thought of as inaccessible. It was essential that we breakdown the false perception that radio astronomy is a big-dish search for extraterrestrial intelligence. (However, there was a concerted effort to do this, too.)

A continuing timeline of progressive involvement is summarized here (all positions are ongoing unless otherwise noted):

Jul 2002	Joined SARA and remain an active member
Jun 2004-Jun 2006	Served on SARA Board of Directors
Jun 2005	Appointed SARA International Ambassador
Jun 2006	Approved SARA/NRAO Navigator
Nov 2006	Appointed SARA Senior Editor of Radio Astronomy

All of these things have been instrumental in astronomy outreach, both in and out of the classroom. Radio astronomy is easily convolved with other types of astronomy. For me, it has facilitated the infusion of culture and art into astronomy presentations, most notably, the literary arts. At first, I melded lectures on radio astronomy with "radio poetry," a sub-genre I created that thematically echoed the lecture, but later, I refined my craft of poetry so that the work was greatly improved and made accessible to all audiences, not just astronomy ones. In a strange way, I can say that radio astronomy has helped me become an emergent voice in literary quality poetry.

Radio astronomy has also enabled unusual presentations in traditionally optical topics areas. For example, as the 11th NASA/JPL Solar System Ambassador for the Great State of Tennessee, my presentation, *NASA Space Exploration and Radio Astronomy*, debuted at the SARA 2008 Conference). The emphasis of space missions is rarely radio.

IX. The Basics

(Editor's Note: An article, with a brief review of some aspect of radio astronomy science, will appear under this title in every issue of The TAOSON Signal.)

The Names of The Various Radio Bands

names:

HF	Below 30 MHz
VHF	30-300 MHz
UHF	300-1000 MHz
Microwaves	1000-30,000 MHz millimeter wave
	Certain microwave bands have acquired

particular

L-band	~20 cm
S-band	~10 cm
X-band	~3 cm
Ku-band	~2 cm
(sometimes	U-band)
K-band	~1 cm

The names of microwave bands are rooted in history, like the s,p,d, f orbitals of atoms; they are commonly met with in practice.

Source: <u>An Introduction to Radio Astronomy</u>, by Bernard F. Burke, Massachusetts Institute of Technology; and Francis Graham-Smith, Jodrell Bank, The University of Manchester