



Radio Waves

Welcome to Yerkes Observatory and the **2002 Center for Cosmological Physics (CfCP) Yerkes Summer Institute!**

Tonight you will begin an exciting week starting with a star party on the South Lawn and followed by a week investigating radio waves. By the end of the week you will have made radio waves and received them, and if we have some luck with space weather you study the nature of enormous explosions on the sun called solar flares and listen to objects the Milky Way Galaxy! The week will end with you designing a “Mission” to communicate with another civilization in the universe, and with you making presentation to your family and fellow students. Don’t worry by the end of the week you will be amazed at what you have learned and what great scientific ideas you can generate.

During the day on Sunday, Monday and Tuesday, you will divided into three groups and will rotate through three extended labs that will help you learn about radio waves and accomplish your mission of designing a way to communicate with another civilization. In the middle of the week you will be “*mixed-up*” into new groups where you will truly become experts in one of the laboratories. Later in the week we will have a “*Jigsaw*” session where a few people from each laboratory group will present the laboratory they became an expert in to the rest of the students. Each night we have a night laboratory/activity that will help you better understand astronomy and radio waves.

Here’s to a great week of investigation and we can hardly wait to listen to your plans to communicate with another civilization in our universe!



2002 Yerkes Summer Institute Format

Driving Questions

These are questions that drive the investigations that you are going to be doing in each lab. As you work through each lab, you will build an understanding of the concepts covered in each of these questions. You are responsible for constructing an answer for each of these questions by the end of the institute.

One or more of the labs will help you reach this goal.

- *How does a radio receiver “catch” radio waves?*
- *What is the role of an antenna in collecting radio waves?*
- *How does a radio transmitter operate?*
- *What are the roles of wavelength, frequency, and resonance?*
- *What role does the Earth’s atmosphere play in radio communication?*
- *What types of things produce radio signals?*

Labs

There are three in-depth daylong investigations. This allows for everyone to participate in **explorations and extensions**. This will give time to process the information. During the hour after dinner groups will recap what they learned that day and how the experiences relate to the Institute Mission. Please use your schedules to identify where you should report. The schedule can be found beginning on page xii.

Mixed-up Group

Each of the three groups will be reorganized or mixed-up to recap and report on one of the labs. This is time to solidify understanding and become an expert on the concepts of a particular lab. Basically clarify what you and or others might be mixed-up with. Please use your schedules to identify what group you are to report with. The group assignments can be found on pages xviii– xix

Jigsaw Session

After your *mixed-up group* has come to some preliminary conclusions about the data you have collected; you will have a chance to share those findings with half of your peers. Your mixed up group will be divided into an #1 group and a #2 group that will then meet with other 1’s or 2’s. Each of you will share with those students the results that your mixed-up group has examined and any conclusion that you have come to based on those results. Other members will listen to you and ask questions, make comments, or suggest possible errors. You will do the same for them when they share their group’s findings. Please use your schedules to identify what Jigsaw group you will report with. The Jigsaw schedule can be found on pages xviii– xix

Mission

The Space Explorers have been commissioned to design a plan that will allow the United States Government to establish communications with another civilization in our universe. Recent evidence suggests compelling reasons to believe that a liquid water ocean exists beneath the ice crust of Jupiter’s moon Europe. Additionally, it seems that almost on a weekly basis astronomers are discovering new planets that are orbiting stars hundreds of light years away. Because of this flurry of new suggestive evidence that there might be other life in our universe you are to design a plan to communicate with that life. The plan must have four components.

1. It **MUST** involve transmitting radio communication.
2. It must involve receiving radio communications,
3. It must have a detailed explanation of what message we would want to send—think of this as a scientific greeting card, and
4. It must have a timeline that indicates the duration of the program and how it will be implemented.

You will make a presentation of your mission to fellow Space Explorers and Scientists.

Mission Work

In your mixed-up groups you will work on your mission task for two hours. This is your time to ask lots of questions, think creatively, and pull together all your ideas from all of the labs.

Mission Conference

At this point, we will bring together the entire group to share your ideas for the mission. Be sure you have something to share in writing as well as orally. These will be displayed for others to see. At a real conference individual groups present plans to a committee and are treated with respect and dignity during and after their presentation. This means that there is no teasing or criticizing of ideas or plans. At the conference everyone is required to write an individual report in his or her lab notebook about all of the presentations made. You are to answer three questions:

1. What were the scientific strong points of the presentation,
2. What were the scientific weak points of the presentation, and
3. Why or why not would you suggest funding for the proposed mission?

NOTE: YOU SHOULD NOT ENTER ANY PERSONAL CRITICISM OF THE ACTUAL PRESENTATION, IN OTHER WORDS YOU SHOULD NOT SAY THAT SOMEONE WAS TOO QUIET, OR SOMEONE TALK TOO SOFT, OR SOMEONE TALKED TOO MUCH. COMMENT ON THE CONTENT ONLY.

Parent Investigation

On Thursday evening your parents and other visitors will participate in an open house. This is your chance to get together with your parents and share what you learned during one of the labs. Think about how to get your parents involved in one part of the lab. Your group presentation should also include insights into how you planned your institute mission. Mixed-up groups will work together for the presentations.





Schedules

2002 CfCP Space Explorers Yerkes Summer Institute Saturday August 3 – Friday August 9

Instructor		Day Lab	Night Lab	Location
KC	Kyle Cudworth		40 Inch Refractor	Main Dome
CB	Charles Brass		Naked Eye Observing	
BF	Bill Fisher	Other Side of Crystal Radio		Basement
WG	Walter Glogowski	Listening to the Sun	Radio Hunt	South Building
MH	Matthew Hedman	Resonance		Library
RH	Ryan Hennessy	Other Side of Crystal Radio		Basement
RL	Randy Landsberg	Resonance		Library
DN	Daisuke Nagai	Listening to the Sun		South Building
PW	Phil Wisecup			

Schedule Overview

	Saturday August 3	Sunday August 4	Monday August 5	Tuesday August 6	Wednesday August 7 (Analysis & Jigsaw)	Thursday August 8 (Analysis & Jigsaw)	Friday August 9
9-11AM		Labs	Labs	Labs	Mixed-up Group Work	Mission Conference	Clean-up and Closing
11:45-1PM	LUNCH						
1:30-2:30PM		Labs	Labs	Labs	Jigsaw Session	Prepare for Parent Investigation in Mixed-up Group	
3-5PM	STAFF MEETING				Mission Work		
5:15-5:30PM	Staff Meeting						
Dinner 5:15-6:30PM	Brief Meeting with TA's						
7:30-8:30	8PM Welcome	Lab Recap	Lab Recap	Lab Recap	Mission/Mixed-up Group Work	7:30-10PM Parents Investigation	
8:30- 10:30PM	8-11 STAR PARTY MAS	PM Labs					

Lab Rotations	Other Side of Crystal Radio	Listening to the Sun	Resonance
Sunday	Kilohertz	Gigahertz	Megahertz
Monday	Megahertz	Kilohertz	Gigahertz
Tuesday	Gigahertz	Megahertz	Kilohertz



Kilohertz's (KHz)

Erica Stevens*	11th
Ashley Hall	9th
Derricka Davis	9th
Jimmie Price	9th
Jessica Dillard	11th
Jerome Anderson	9th
Jerome Coleman	8th
Michael Dunlap	11th

Kilohertz Lab Rotation (Sunday, Monday, Tuesday)

When	What	Where	Who
Sunday Aug. 4			
Day Lab	Other Side of Crystal Radio	Basement	Ryan Hennessy Bill Fisher
7:30-8:30 (Recap)	Other Side of Crystal Radio Recap	Basement	Ryan Hennessy Bill Fisher
Night Lab 8:30-10:30	To be determined		
Monday Aug. 5			
Day Lab	Listening to the Sun	South Building	Walter Glogowski & Daisuke Nagai
7:30-8:30 (Recap)	Listening to the Sun Recap	South Building	Walter Glogowski Daisuke Nagai
Night Lab 8:30-10:30	To be determined		
Tuesday Aug. 6			
Day Lab	Resonance	Library	Randy Landsberg Matt Hedman
7:30-8:30 (Recap)	Resonance Recap	Library	Randy Landsberg Matt Hedman
Night Lab 8:30-10:30	To be determined		



Megahertz's (MHz)

Ashley McCann	12 th
Paula Montgomery	6 th
Christopher Howard	11 th
Montrice Wade	11 th
Christopher Smith	10 th
Mia Dunlap	9 th
Albert Sweeten	10 th
Timotheus Gordan Jr.	9 th

Megahertz Lab Rotation (Sunday, Monday, Tuesday)

When	What	Where	Who
Sunday Aug. 4			
Day Lab	Resonance	Library	Randy Landsberg Matt Hedman
7:30-8:30 (Recap)	Resonance Recap	Library	Randy Landsberg Matt Hedman
Night Lab 8:30-10:30	To be determined		
Monday Aug. 5			
Day Lab	Other Side of Crystal Radio	Basement	Ryan Hennessy Bill Fisher
7:30-8:30 (Recap)	Other Side of Crystal Radio Recap	Basement	Ryan Hennessy Bill Fisher
Night Lab 8:30-10:30	To be determined		
Tuesday Aug. 6			
Day Lab	Listening to the Sun	South Building	Walter Glogowski Daisuke Nagai
7:30-8:30 (Recap)	Listening to the Sun Recap	South Building	Walter Glogowski Daisuke Nagai
Night Lab 8:30-10:30	To be determined		



Gigahertz's (GHz)

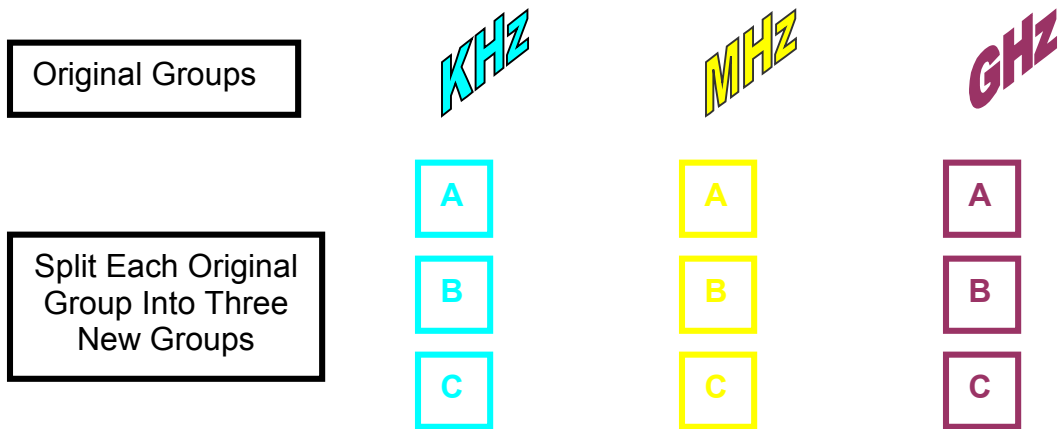
Larry McDonald	11th
JaVal Howard	7th
Jameal Mathis	9th
Melissa Blakey	11th
Jeminat Onisemoh	10th
Arron Lucas	12th
Janel Woods	12th
Monashae Brownlee	9th

Gigahertz Lab Rotation (Sunday, Monday, Tuesday)

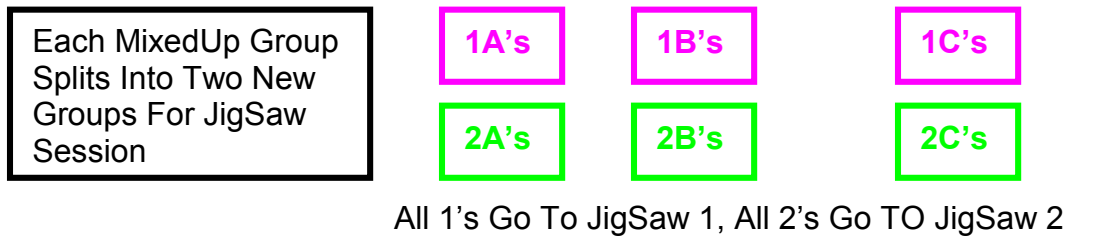
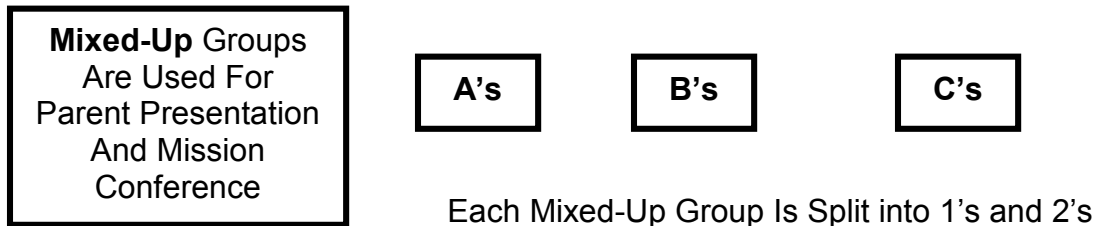
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Sunday Aug. 4			
Day Lab	Listening to the Sun	South Building	Walter Glogowski Daisuke Nagai
7:30-8:30 (Recap)	Listening to the Sun Recap	South Building	Walter Glogowski Daisuke Nagai
Night Lab 8:30-10:30	To be determined		
Monday Aug. 5			
Day Lab	Resonance	Library	Randy Landsberg Matt Hedman
7:30-8:30 (Recap)	Resonance Recap	Library	Randy Landsberg Matt Hedman
Night Lab 8:30-10:30	To be determined		
Tuesday Aug. 6			
Day Lab	Other Side of Crystal Radio	Basement	Ryan Hennessy Bill Fisher
7:30-8:30 (Recap)	Other Side of Crystal Radio Recap	Basement	Ryan Hennessy Bill Fisher
Night Lab 8:30-10:30	To be determined		



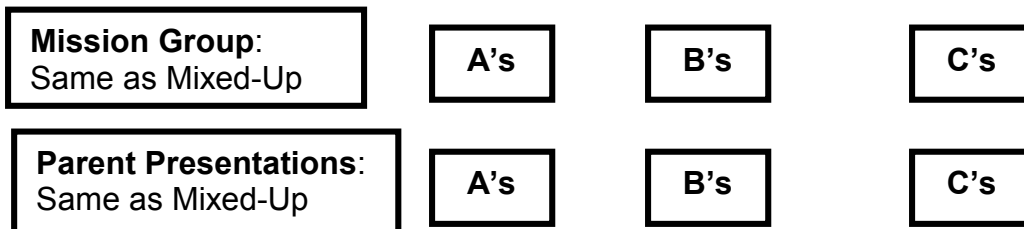
Group Organization Visual



Move all A, B, and C's together into new "MixedUp" Groups



Recap:



Frequency Codes

Kilohertz's

Erica Stevens*	11th
Ashley Hall	9th
Derricka Davis	9th
Jimmie Price	9th
Jessica Dillard	11th
Jerome Anderson	9th
Jerome Coleman	8th
Michael Dunlap	11th

Megahertz's

Ashley McCann*	12 th
Paula Montgomery	6th
Christopher Howard	11th
Montrice Wade	11th
Christopher Smith	10th
Mia Dunlap	9th
Albert Sweeten	10th
Timotheus Gordan Jr.	9th

Gigahertz's

Larry McDonald*	11th
JaVal Howard	7th
Jameal Mathis	9th
Melissa Blakey	11th
Jeminat Onisemoh	10th
Arron Lucas	12th
Janel Woods	12th
Monashae Brownlee	9th

ASSINGMENTS

	Mixed up Lab	Jigsaw
Kilohertz Group		
Erica Stevens*	Other Side of Crystal Radio	1
Ashley Hall	Other Side of Crystal Radio	2
Derricka Davis	Listening to the Sun	1
Jimmie Price	Listening to the Sun	2
Jessica Dillard	Resonance	1
Jerome Anderson	Resonance	2
Jerome Coleman	Resonance	1
Michael Dunlap	Other Side of Crystal Radio	1
Megahertz Group		
Ashley McCann*	Listening to the Sun	1
Paula Montgomery	Other Side of Crystal Radio	2
Christopher Howard	Listening to the Sun	2
Montrice Wade	Listening to the Sun	1
Christopher Smith	Resonance	2
Mia Dunlap	Resonance	1
Albert Sweeten	Other Side of Crystal Radio	1
Timotheus Gordan Jr.	Listening to the Sun	2
Gigahertz Group		
Larry McDonald*	Resonance	2
JaVal Howard	Other Side of Crystal Radio	2
Jameal Mathis	Listening to the Sun	1
Melissa Blakey	Listening to the Sun	2
Jeminat Onisemoh	Resonance	1
Arron Lucas	Resonance	2
Janel Woods	Other Side of Crystal Radio	1
Monashae Brownlee	Other Side of Crystal Radio	2



MIXED-UP LAB ASSIGNMENTS

<i>Other Side of Crystal Radio (A's)</i>	<i>Listening to the Sun (B's)</i>	<i>Resonance (C's)</i>
Erica Stevens*	Derricka Davis	Jessica Dillard
Ashley Hall	Jimmie Price	Jerome Anderson
Michael Dunlap	Ashley McCann*	Jerome Coleman
Paula Montgomery	Christopher Howard	Christopher Smith
Albert Sweeten	Montrice Wade	Mia Dunlap
JaVal Howard	Timotheus Gordan Jr.	Larry McDonald*
Janel Woods	Jameal Mathis	Jeminat Onisemoh
Monashae Brownlee	Melissa Blakey	Arron Lucas

JIGSAW 1	JIGSAW 2
Derricka Davis	Jimmie Price
Ashley McCann*	Christopher Howard
Montrice Wade	Timotheus Gordan Jr.
Jameal Mathis	Melissa Blakey
Erica Stevens*	Ashley Hall
Michael Dunlap	Paula Montgomery
Albert Sweeten	JaVal Howard
Janel Woods	Monashae Brownlee
Jessica Dillard	Jerome Anderson
Jerome Coleman	Christopher Smith
Mia Dunlap	Larry McDonald*
Jeminat Onisemoh	Arron Lucas

