



EclipseMob



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Partners:



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2017**

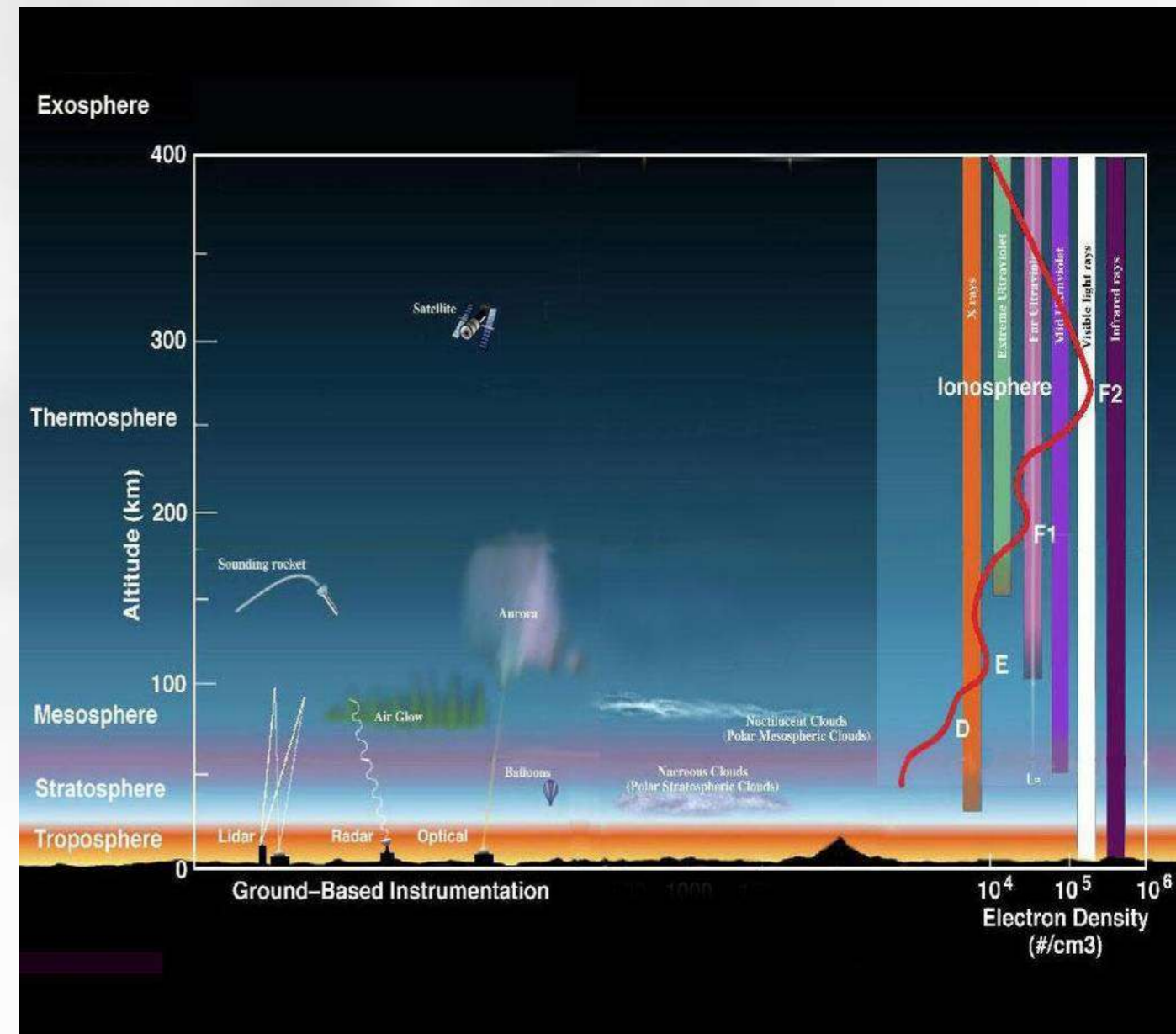


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Primary research questions

- What is the rate of ionization and deionization of the ionosphere during an eclipse event?
- How does wave propagation vary over a geospatial distribution along the eclipse path?



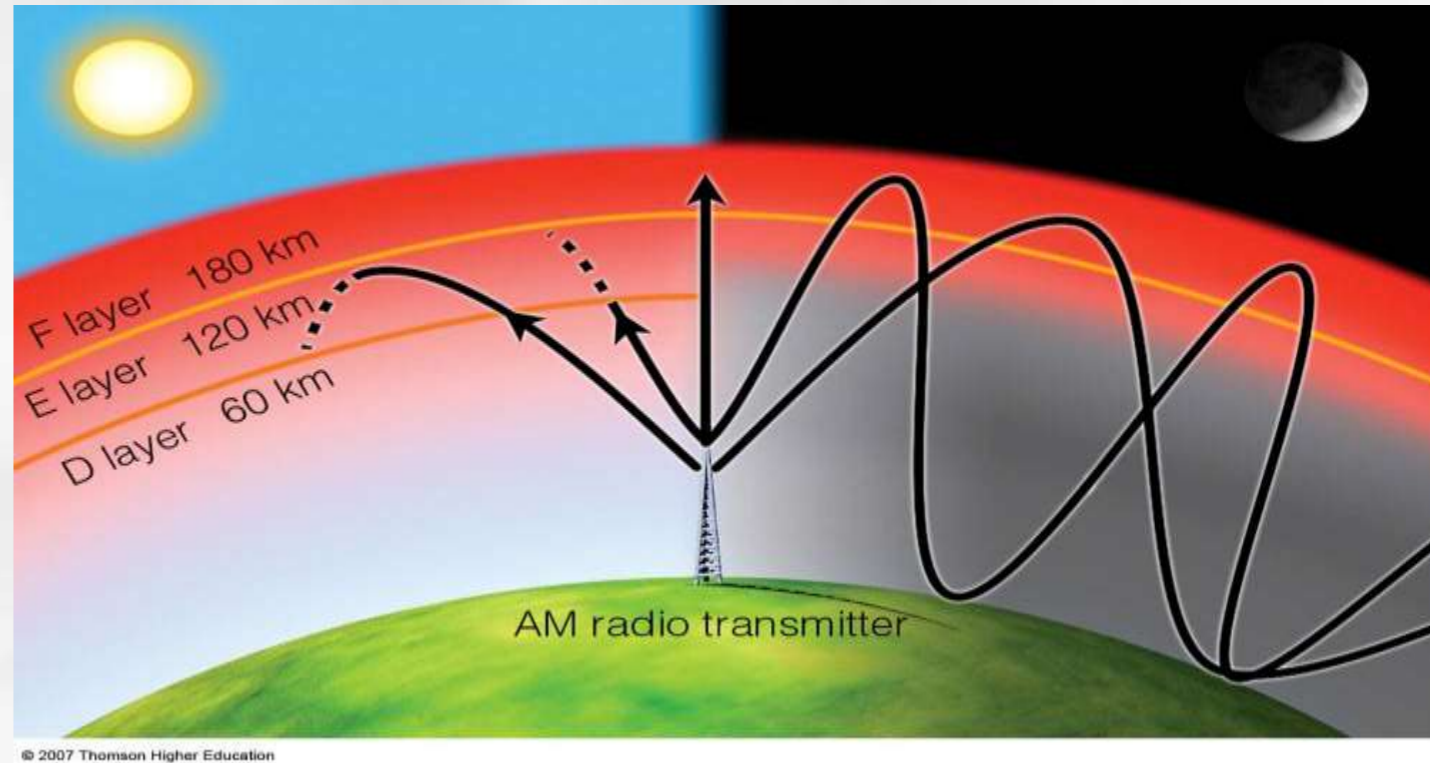
NASA's depiction of ionosphere relative to other layers

Why use a solar eclipse to study radio wave propagation?

- Night & day differences in propagation

- Sunrise and sunset are very gradual events and characterized by:

1. Large angle of the sun changing and thus very different paths through the atmosphere
2. Rapid temperature changes



- **Solar eclipses do not demonstrate these challenges!**



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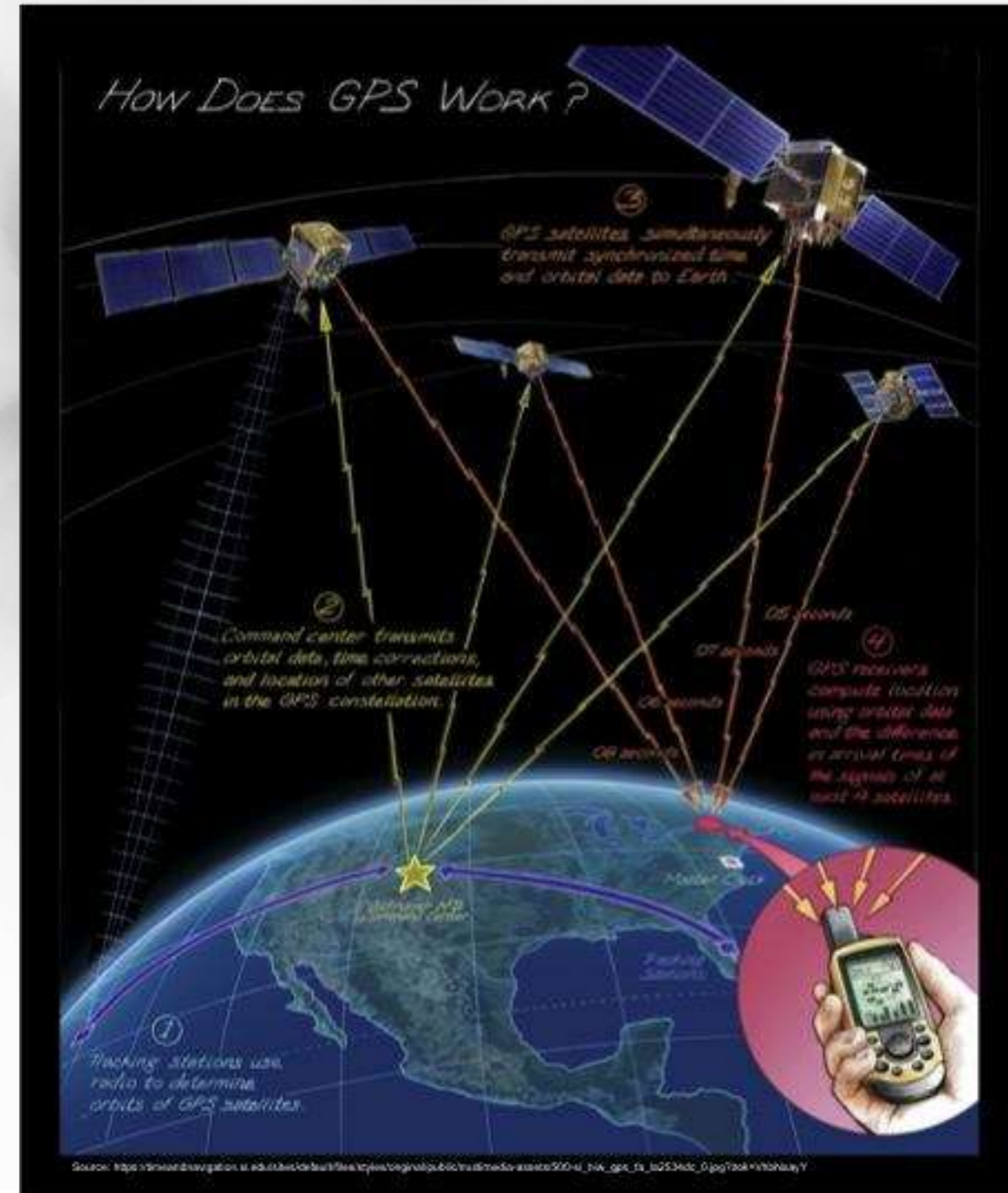


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Why is this study important?

- **Fundamental science:** We don't fully understand the ionosphere.
- **Impact on humans:** GPS satellite signals are affected by the ionosphere, impacting ground spatially resolved distance; long distance radio communication; other satellite signals



What is the EclipseMob project?

Crowdsourced effort to conduct a large-scale low-frequency radio wave propagation experiment during the 2017 solar eclipse

A map of our participants (so far) across the U.S.



Crowdsourcing affords a large enough dataset for meaningful analysis.



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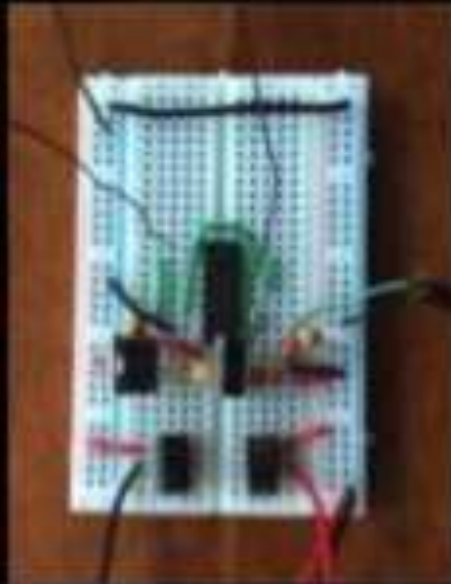


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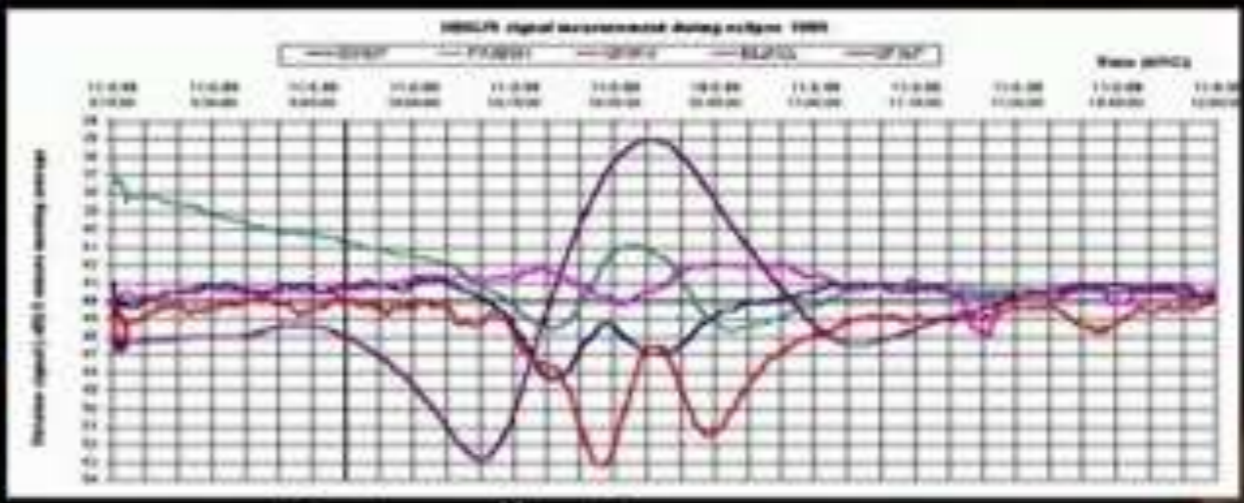
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The Experiment

A. People across N. America build & test receiver systems.



B. WWVB antenna (shown) transmits signal at 60 kHz (& another signal from navy) while people receive signals.



C. Uploaded data analyzed for spatial distribution



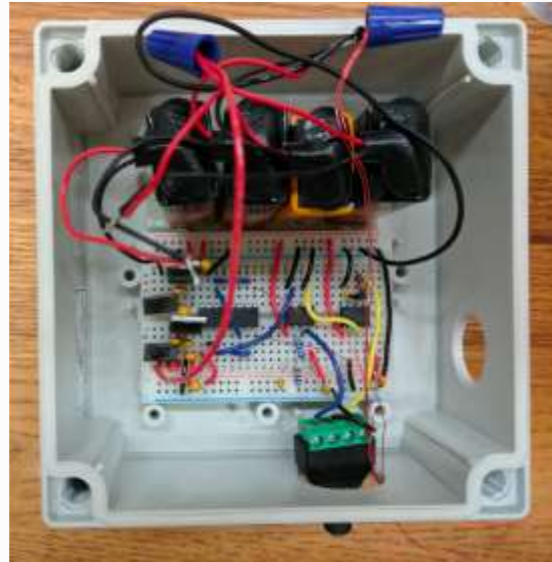
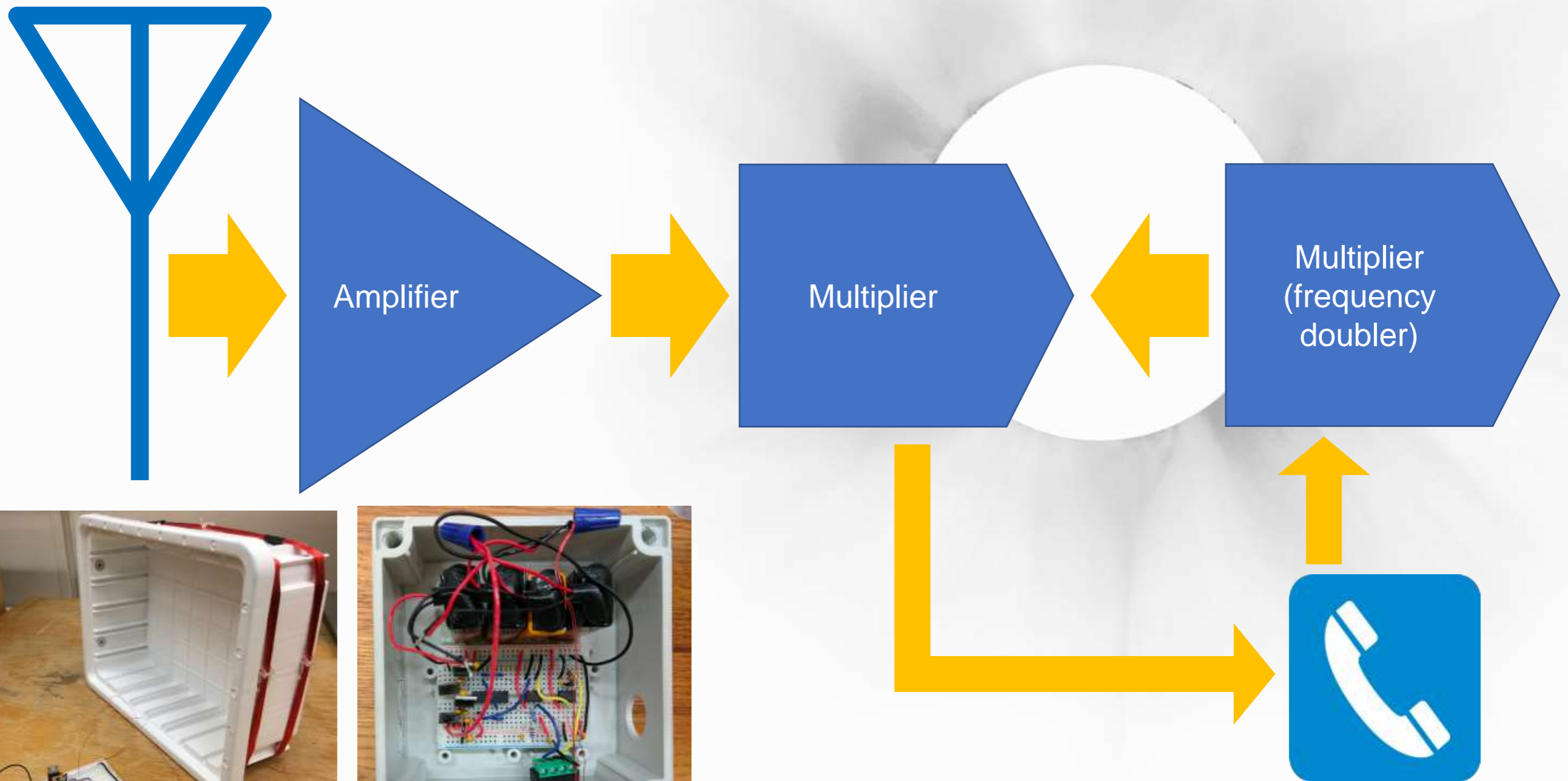
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How does the receiver system work?



Special thanks to undergraduate design teams at UMass--Boston & GMU; esp. Kevin Keegan for design work!



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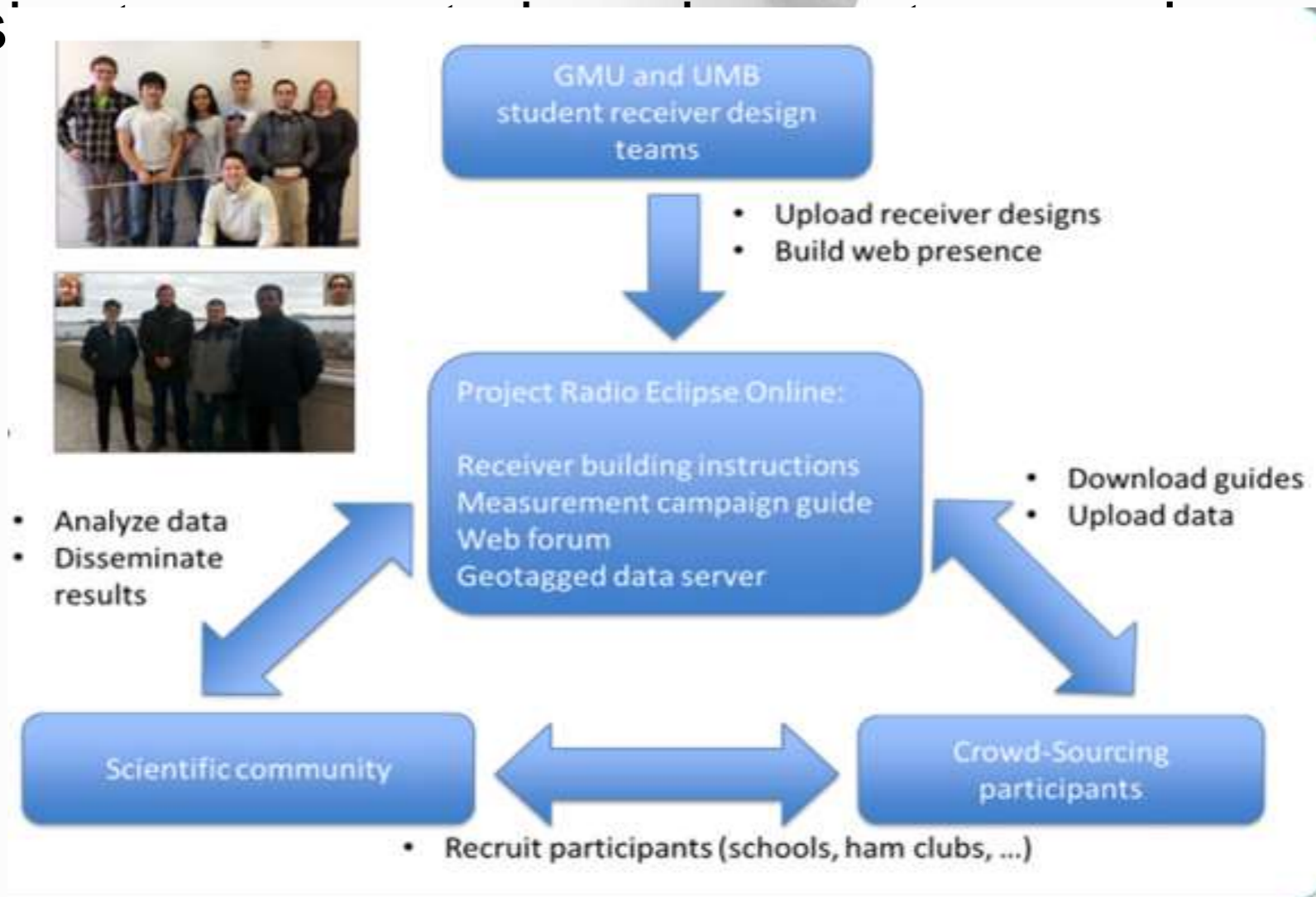
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Science and citizen collaboration

Anyone can collect low-frequency radio wave propagation data.

GMU and UMB faculty and students manage the project.

Student des



Project activities

Designing receiver

systems/software and
assembling kits

Creating web portal:

EclipseMob.org

Designing and sharing K-

12 lesson plans

Educational Webinars (with
the Geological Society of
America)

Public engagement events to
get others to build

The screenshot shows the EclipseMob website interface. At the top, there is a navigation bar with links for HOME, LOGIN, REGISTER, and FORUM. The main header features a large graphic of a satellite in space, the sun, and radio waves reflecting off the ionosphere layers (F2, F1, E, D). Below the graphic, the website is organized into a grid of content blocks:

- Build:** Our guides will help you build your own radio receiver system!
- Learn:** Find out more about how eclipses happen, radio waves work, and the ionosphere behaves! (For Educators: Activities & lesson plans can be found here)
- Share:** Connect with other participants and get tips on how to communicate your results!
- Experiment:** Take part in a nation-wide experiment!
- News & Events:** Find the latest updates on upcoming webinars, Q & A events, experiment logistics, etc.
- About Us:** Meet the EclipseMob team!
- Contact Us:** Do you need to contact the EclipseMob?
- Resources:** Interested in other Eclipse related material? Check out these resources!



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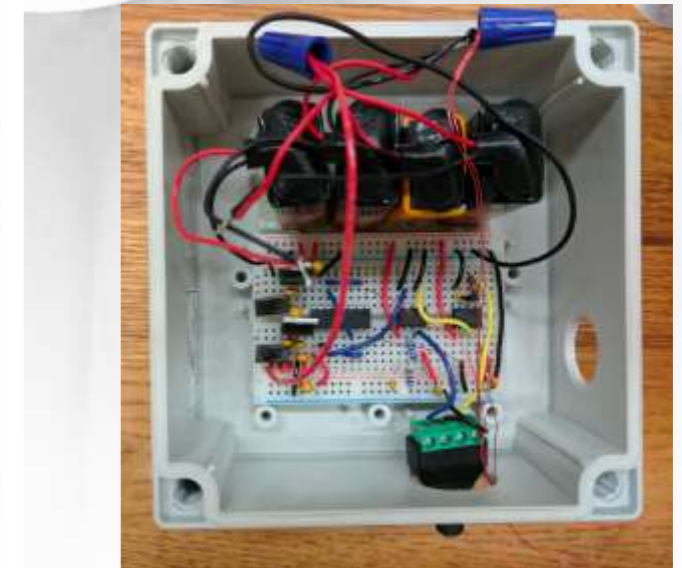
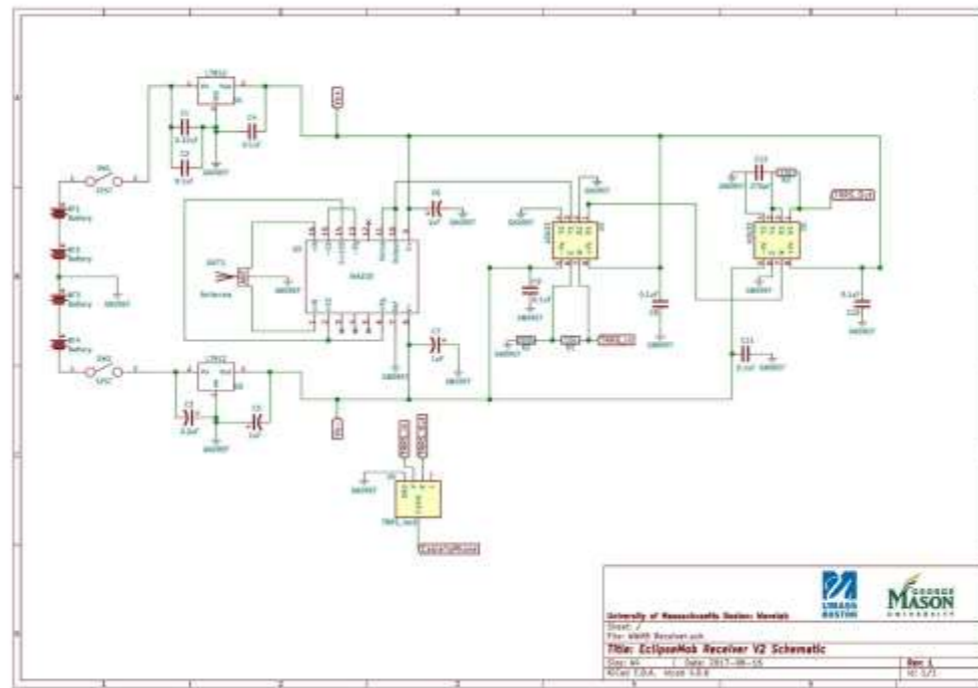


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EclipseMob kit

- Kit includes step-by-step directions and requires no soldering (more accessible).
- All free (NSF-funded) kits have been spoken for, but interested participants can order their own parts -- see the “Build” section of EclipseMob.org!



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Public outreach events

Organizers have given talks to increase public awareness & recruit participants at conferences, hamventions, public libraries, museums, and via webinars.



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Public outreach events, cont.

Receiver build event at George Mason University MIX (April 2017)

Participants of all ages gathered to build kits and antennas in a scaffolded, “just in time” support environment



Special thanks to the folks at George Mason’s Makerspace (M.I.X.) that assisted with the event!



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Public outreach events, cont.



- **Q&A Event at George Mason University & via Google Hangout (July and August 2017)**

Participants who have assembled receiver kits gathered to discuss project-related questions with amateur radio professionals.

Special thanks to **George Lemaster** who has informally joined the team to provide technical support to participants at outreach events!



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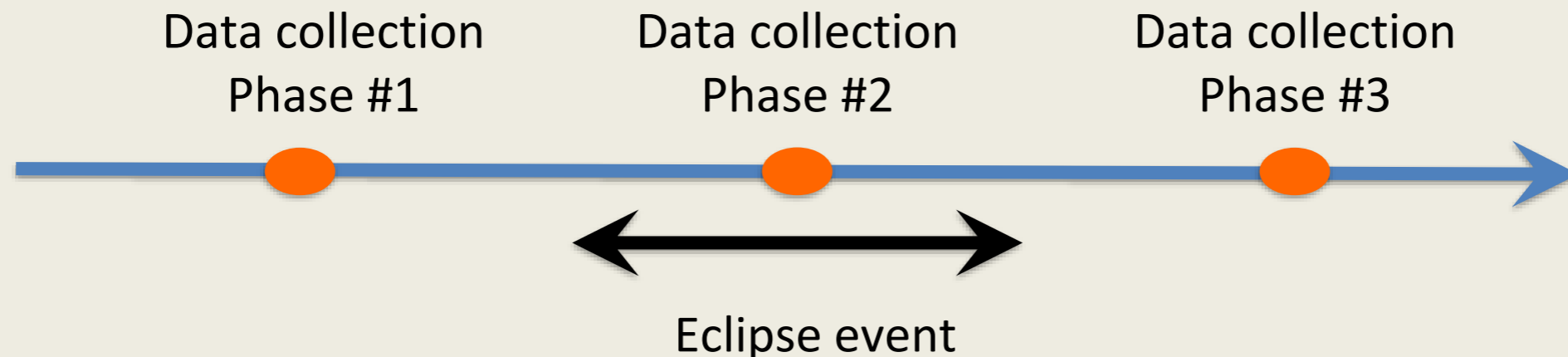
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How can **you** participate in EclipseMob?



We need your help! We need to collect spatially diverse signals before, during, and after the eclipse.



Build a simple receiver.

- **Connect** the receiver to your smartphone or tablet.
- **Collect** data before, during, and after the eclipse on August 21, 2017.
- **Upload** your data to the EclipseMob website.



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What happens after the experiment?

1. Participants will **submit** data and **receive** certificates of contribution.
2. Data will be **compiled, cleaned, and analyzed** to produce wave propagation maps.
3. Results will be **sent** to participants, **posted** on site, and **shared** at conferences.
4. Participants can **reuse** kits to conduct similar experiments under different conditions or **repurpose** parts for new systems/experiments.
(Coming soon to EclipseMob.org)



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Project reach to date

150 kits have been claimed.

Additional participants interested in building their own receiver.

80+ people follow the EclipseMob Facebook page.

Over **100** views on EclipseMob forum posts.

Over **7000** hits on EclipseMob.org.



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Laura Lukes: Project management; education, outreach, and evaluation design & management; graduate student mentor -- llukes@gmu.edu

K.C. Kerby-Patel: Receiver & software design; kit development; undergraduate & graduate student mentor -- KC.Kerby-Patel@umb.edu

Jill Nelson: Signal processing; project and grant management; outreach; graduate student mentor -- jnelson@gmu.edu

Bill Liles: Experiment design; technical support; outreach; graduate student mentor

Jennifer Henry: Communication & outreach specialist; MS cyber security graduate student

Janet Oputa: Communication & outreach specialist; MPH graduate

Partners:



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