



# Selling Citizen Science Opportunities in IOTA



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IOTA Meeting Presentation

July 17 & 18, 2021



## Citizen Science Defined

- From Oxford Languages: “the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists.”
- What part of the work done by volunteers for IOTA is Citizen Science?

**EVERYTHING!**



## Purpose of this Presentation

- Give ideas for outreach to astronomy enthusiasts
- Show the scope of IOTA Citizen Science activities
- Describe some of the resources available to presenters
- Provide suggestions for what to include
  - An example presentation is available via [occultations.org/citizen science](http://occultations.org/citizen%20science)
  - Examples of IOTA CS successes
- Highlight IOTA CS website for all to use

# International Occultation Timing Association



Profile of 90 Antiope

30 miles  
50 km

Jul 19, 2011 occultation of the binary asteroid (90) Antiope

https://occultations.org/citizen-science-with-iota/ 7/18/2021

Welcome to the home page of the International Occultation Timing Association (IOTA). IOTA is a volunteer science and research organization born in 1983. We gather data from timings of astronomical occultations and provide a variety of educational resources to promote and encourage observations of astronomical occultations.

We provide predictions of occultations of stars by asteroids and the Moon, and of grazing occultations of stars by the mountains of the Moon's north and south polar regions. By observing and timing occultations, amateurs have contributed to the discovery of new double stars, improved knowledge of the shape and orbits of hundreds of asteroids and helped map the Lunar polar regions.

We provide information and recommendations on observing equipment and techniques, and we report and publish our data in scientific journals. Amateur astronomers at all levels

## IOTA Citizen Science Page

<https://occultations.org> is a key resource for IOTA. The Citizen Science link is where examples of IOTA work is presented. A sub-page under development will host a suggested outreach presentation, more ideas on outreach, and provide links to software, predictions, user guides, and more.<sup>4</sup>

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## Citizen Science with IOTA

July 20, 2021

7/18/2021

## Example Presentation

- Can be used as is
- Can also be modified to fit the group needs
- Consider deleting what isn't needed as this is very long
- Examples from the presentation in the following slides
- Please let us know if you have suggestions for improvement

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## **We want audiences to understand that IOTA members:**

- **Provide predictions for occultations of stars by asteroids, planets, and the Moon**
- **Encourage and facilitate the observation and measurement of occultations and eclipses, coordinate observing efforts among members and with other observing campaigns**
- **Provide software and information on observing equipment and techniques**
- **Report and publish observations**
- **Teach others observing techniques, software use, data evaluation**
- **Provide equipment and software available nowhere else**

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## Tailor the presentation to the audience and to the venue

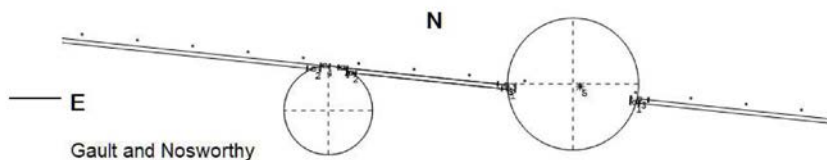
- If you do not know if the attendees know what an occultation is, ask them. Or ask for a show of hands of how many have seen an occultation.
  - The example presentation has more technical discussions on observing at its end, which may be too much for less experienced audiences.
  - Only spend your (often scarce!) presentation time on introductory descriptions of occultations if the audience needs that.
- Membership in IOTA or in the email group is not required, but should be offered. Distribute the information with flyers.
- Do not interrupt the presentation to present videos. And only incorporate them into the presentation if you are very familiar with the presentation equipment.

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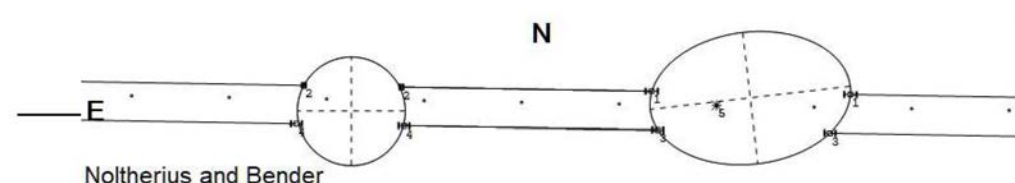


## Provide Examples of Recent IOTA Successes

- Here are two exciting results from the Citizen Science presentation
  - Near Earth Asteroid observation successes
    - (3200 ) Phaethon
    - (99942 ) Apophis
  - Asteroid satellite detection and satellite confirmation
    - (4773) Arcibo
      - First detected by occultation in May
      - Confirming detection by occultation in June
      - Discovery announcement broadcast by the Central Bureau for Astronomical Telegrams



7/18/2021

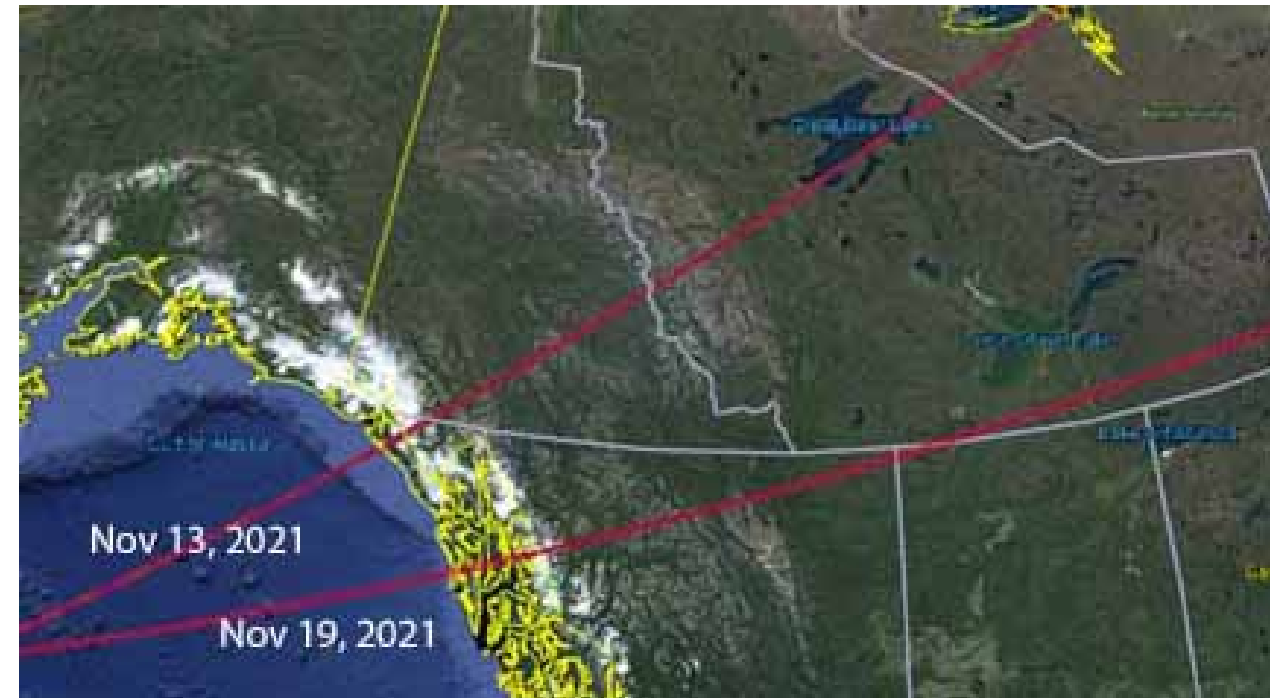




## Occultations by NEA's

- Explain why NEA's are important to us all
  - Earth impact concerns
  - Easier target for satellite missions
  - Draws significant attention from space agencies, scientists, and public
- Explain what makes predictions and observations more difficult
  - Small asteroids more easily perturbed by smaller non-gravitational effects
  - Small size makes occultation durations short
  - Short time span for reasonable occultation observing within the limits of current camera systems when NEAs are not close to the Earth
  - Only observable by Earth-based systems during a fraction of their orbits, making predictions less reliable

### Phaethon Occultations Nov 2021



Two occultations by Phaethon in November 2021 with some good parameters but only 0.2 sec duration.

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## (3200) Phaethon and (99942) Apophis

- Two NEAs which were recently observed
- (3200) Phaethon
  - Thought to be the parent body for Geminid meteor shower
  - Interesting non-gravitational effects
  - Successfully observed with an intensive campaign in 2019
  - Somewhere in between a comet and an asteroid?
- (99942) Apophis
  - Was considered potentially hazardous to Earth
  - Successful occultation observing campaign reduced the hazard potential to extremely unlikely although it will pass very close in 2029
  - Observable January – September of this year
- Separate paper by David on both these asteroids and the campaigns to observe their occultations, so there is a wealth of information



## Predictions-Rest of 2021 in North America

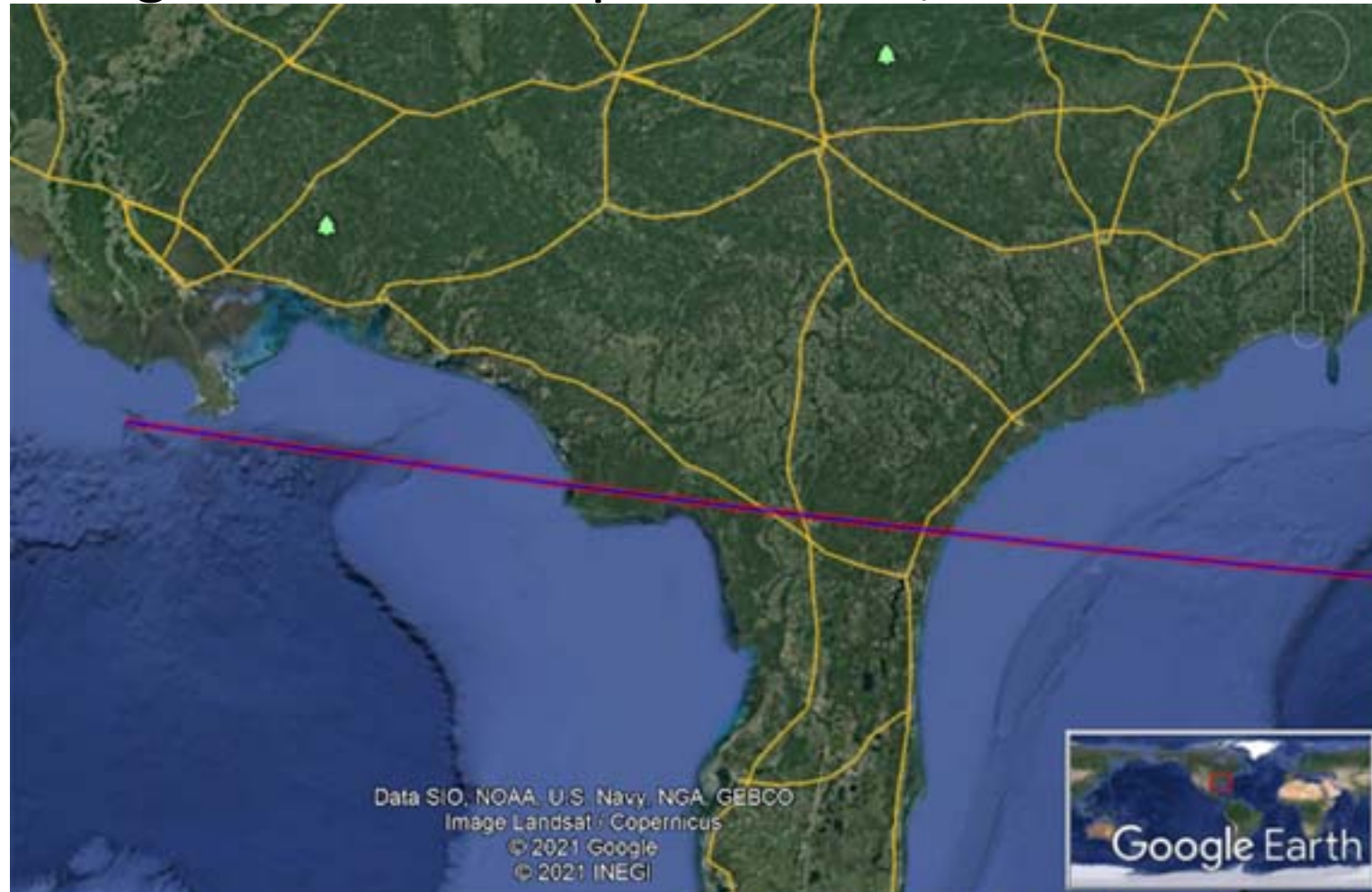
- Give predictions for major events, interesting events, events local to the area
  - Generate local predictions with Occult4, get asteroid path data from Occultwatcher
- Examples of events to highlight
  - Upcoming events from Steve Preston's list of good events for 2021
  - Bright stellar occultations
- Events which have particular significance, but pose more difficulty for new observers
  - Apophis – one event for Sept 27, which will be very difficult. The predicted maximum occultation duration is 0.02sec
  - Phaethon – multiple opportunities, all difficult
  - Lucky Star or spacecraft mission support events, where first notice can come with little notice prior to the event time

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## (99942) Apophis Occults 8.5mag SAO 98045 September 27, 2021

- A very difficult event, duration 0.02sec
- Elevation 9 deg
- Few in a general audience will attempt the observation
- Audiences are interested as Apophis is an interesting object





## Where to Find Information on Upcoming Occultations

- Lunar Occultations – bright stars
  - <http://lunar-occultations.com/iota/iotandx.htm> (left side of the page)
- Asteroid Occultations
  - Steve Preston's best of the year – <https://www.asteroidoccultation.com/2021-BestEvents.htm>
- Planetary Occultations
  - Planets by the Moon - <http://lunar-occultations.com/iota/planets/planets.htm>

These are not the only sources, but they are a good place to find the ones that are the easiest to observe.

## Observing Considerations

- Describe observing equipment suitable to the audience level
- Recommend data capture/recording techniques
- Suggest techniques for observing
- Other ideas
  - Demonstrate use of equipment after the talk
  - Show videos of equipment set-up and use
- Many people already own scopes that can be used for observing – it's the rest of the kit they won't have.



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## Observing Equipment

- Good data can be obtained with relatively modest equipment
- Multiple opportunities to observe occultations of stars 10<sup>th</sup> mag and brighter everywhere in any given year.
- Encourage observers to practice with lunar occultations
  - Even experienced observers can use an occasional practice
  - Opportunities to test equipment and software
  - Lunar occultations also have value and their observations should be reported



## What do Observers Need from Us?

Assistance in determining suitable equipment

Predictions for events

Instructions on how to use the software

Identification of opportunities for observing practice

Encouragement!



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For those who do not observe but still want to help

- Multiple non-observing activities are also part of IOTA
  - Note that observing experience aids in understanding what is needed
- Develop equipment or software for observing
- Already have an observatory or funds to obtain one? Perhaps there could be an opportunity for an automated observatory.
- Other ways to help
  - Web site maintenance
  - Outreach



## More for Outreachers

- Files of the posters on IOTA activities and an IOTA floor banner are available for printing. They are in PowerPoint format under the 2017 IOTA meeting presentations.
- The large IOTA banner can be borrowed from the secretary
- The IOTA Citizen Science and Campaign pages on the occultations.org web site have more information for would-be observers
- An Outreach Support page accessed from the Citizen Science page is under development and will host
  - A link to a sample Power Point presentation
  - Links to flyers on IOTA, IOTA membership
  - Where to find software
  - Links to predictions

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## Final

- End the presentation with predictions for easily observed upcoming events in their area
- Leave the audience with something physical – a membership flyer, list of predictions, list of software.
  - Flyers provided for you to print
- Suggest a group occultation boot camp to hone observing skills – see later presentation

*Please note these are my personal recommendations, not official pronouncements from IOTA. And hurrah to anyone who gives occultation outreach presentations!*

7/18/2021

