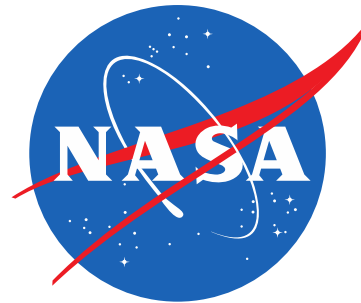
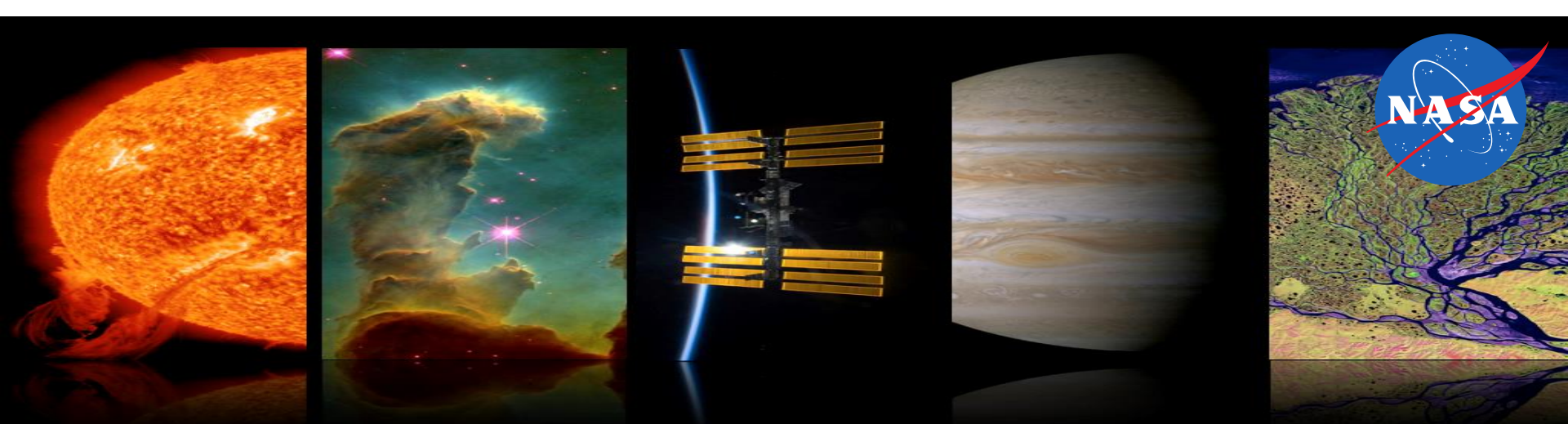


# Citizen Science as a Tool for Scientific Research and Societal Benefit at NASA



Dr. Amy Kaminski  
NASA Headquarters, USA  
Australian Citizen Science Association Conference  
February 7, 2018



- NASA's **strategic goals** include advancing knowledge and opportunity in space and improving life on Earth.
- We support these goals through extensive programs in **space and Earth science research** accomplished via **space-based missions** and **research funding**.
- NASA's "system" is configured to conduct science using (1) **in-house personnel** and (2) **grants, contracts, and agreements** with **external entities** (academia, industry, international space agencies).

# NASA's Citizen Science Universe

- + NASA-funded
- ^ Uses NASA data/assets
- \* Completed/defunct
- # Challenge/prize competition

Disk Detective  
Planet 9: Backyard Worlds  
+Planet Hunters  
^Galaxy Zoo  
^Radio Galaxy Zoo  
^Exoplanet Explorers

JunoCam

+Target Asteroids  
+Asteroid Mappers  
\*\*Asteroid Data Hunter Challenge  
Citizen science Asteroid Data,  
Education, and Tools (CADET)  
projects

\*\*Cassini Rings Challenge

+Stardust@home

Aurorasaurus  
Meteor Counter

+Mercury Mappers

+Moon Mappers  
^Moon Zoo

^Student Spaceflight  
Experiments Program

\*\*Open NASA Earth Exchange Challenges  
NASA S'COOL  
NASA/USGS Adopt-a-Pixel  
GLOBE/GLOBE Observer  
Ecological forecasting using crowdsourcing (multiple projects)  
\*\*Climate Resilience Data Challenge  
\*General Aviation Study of Harmful Algal Blooms  
Citizen Science for Earth Systems Programs (multiple projects)

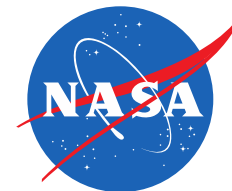
+Mars Mappers  
\*Clickworkers  
^Planet Four  
^Planet Four: Terrains  
Planet Four: Ridges

\*Astrobiology Citizen Science  
\*MAPPER



\*\*Mars Balance Mass Challenge

# Extending Astrophysics Research Capabilities: *Disk Detective*



- WISE telescope data analysis
- 28,000+ volunteers with no professional training; **depth of knowledge replaced by volume of participation**
- Speeds completion of research – 2.5 million images reviewed since 2014
- “Super users” become part of research team – named on published papers

**DISK + DETECTIVE**

Finding planetary systems with help from 28,000 new colleagues.

ZOONIVERSE  
REAL SCIENCE ONLINE

The image is a promotional banner for the Disk Detective project. It features a central photograph of a person using a laptop. The laptop screen displays the Disk Detective web interface, which includes several panels with astronomical images. Above the laptop, the text "DISK + DETECTIVE" is written in a stylized font, with a magnifying glass icon over the plus sign. To the right of the laptop, there is a close-up image of a protoplanetary disk. In the bottom left corner, there is an image of a satellite in space. The bottom right corner contains the NASA logo, the Zooniverse logo, and the text "ZOONIVERSE REAL SCIENCE ONLINE".

# Refining Predictive Models of Auroral Activity: *Aurorasaurus*



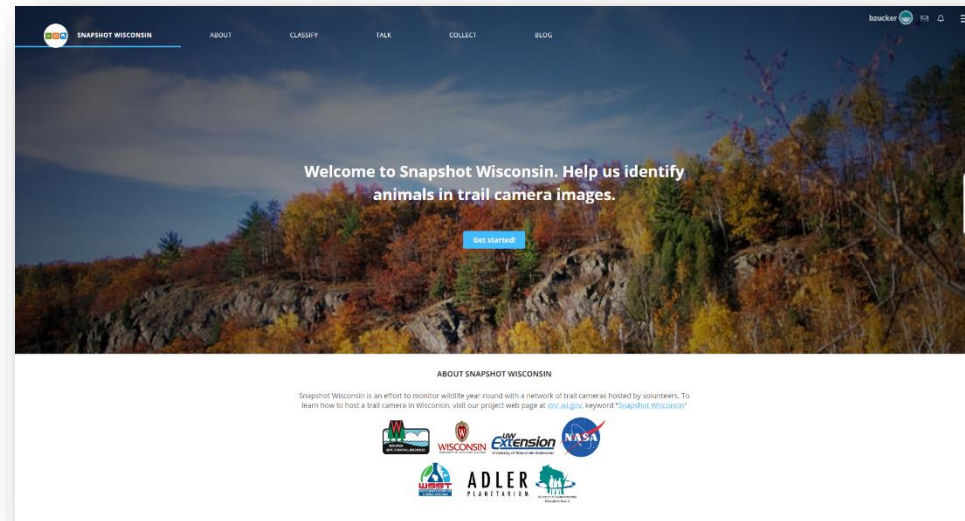
- # reports
- # users
- Scientific and societal outcomes



# Supporting Wildlife Monitoring and Management: *Snapshot Wisconsin*



- Led by Wisconsin (USA) Dept. of Natural Resources
- 800+ citizen scientists set up nearly 1000 trail cams; 17M+ images taken; analyzed on Zooniverse
- Public engaged through training, communication of results, volunteer recognition
- Trail cam and remote sensing data merged to understand wildlife population-landscape interactions for environmental and wildlife management



*Let's discover our wildlife together!*

# Supporting Ecological Planning: *Dynamic Conservation for Migratory Birds*



- Reynolds et al. (2017) analyzed e-Bird (citizen science) data and remote sensing data to determine temporal and spatial gaps in wetland habitat availability during annual water bird migrations in California, USA
- The Nature Conservancy used reverse auction to incent landowners to create temporary wetlands on their properties
- Demonstrates flexible land management that meets both conservation and economic interests



*Photo credit: James R. Nelson, California Dept. of Fish and Game*



# Much work remains to expand NASA's use of citizen science

## *Science community comfort*

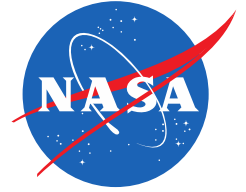
- Science community's lack of familiarity with citizen science methods
- Volunteer data quality concerns

## *Funding challenges*

- Established funding paths
- "Isn't it E/PO?"
- Facing the review panel



# Encouraging the use of citizen science within NASA



- Policy statements
- Dedicated funding opportunities
- Individual champions
- Community of practice
- Meetings/events to familiarize NASA workforce with citizen science and its applicability to their work
- Workshops involving the science and open innovation communities to develop ideas for new projects

