Immersive Exoplanet Explorer (VR) Concept

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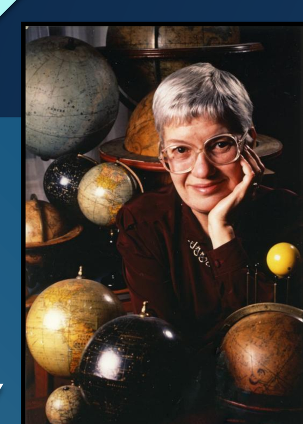
Jacyszyn, A. 2025, in *Proceedings of the DiTraRe Symposium on Digitalisation of Research*, “A Bridge over Deep Space: Astronomy and AI” (Eggenstein-Leopoldshafen, Germany: FIZ Karlsruhe–Leibniz Institute for Information Infrastructure)

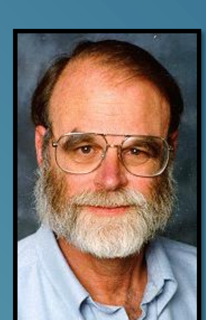
SETTING STARS EXOPLANETS

CAL STATE LA

EXADATA



FOURTH PARADIGM OF SCIENCE DISCOVERY



Gray argued that a new scientific paradigm had emerged—*data-intensive science*—where:

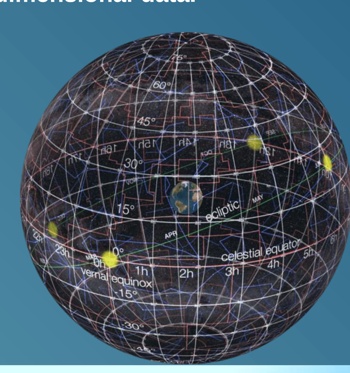
- Datasets are too large to inspect manually
- Search/query is as important as theory or experiment
- Visual computing unlocks patterns otherwise invisible
- Scientific discovery becomes an *iterative conversation* with data

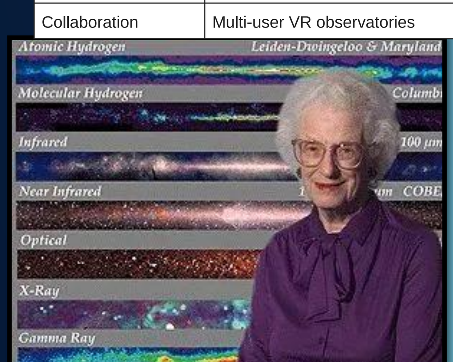
This exactly matches the landscape of modern astronomy:

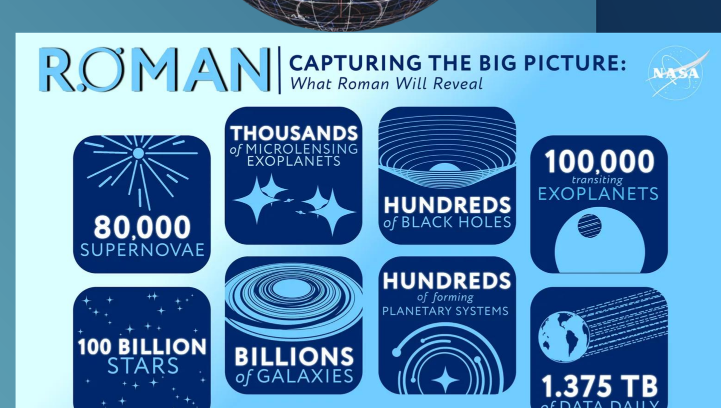
- Gaia DR3: 1.8+ billion stars
- TESS: tens of millions of light curves
- LSST: 20TB *per night*
- NExScI archives: multi-mission cross-linked data

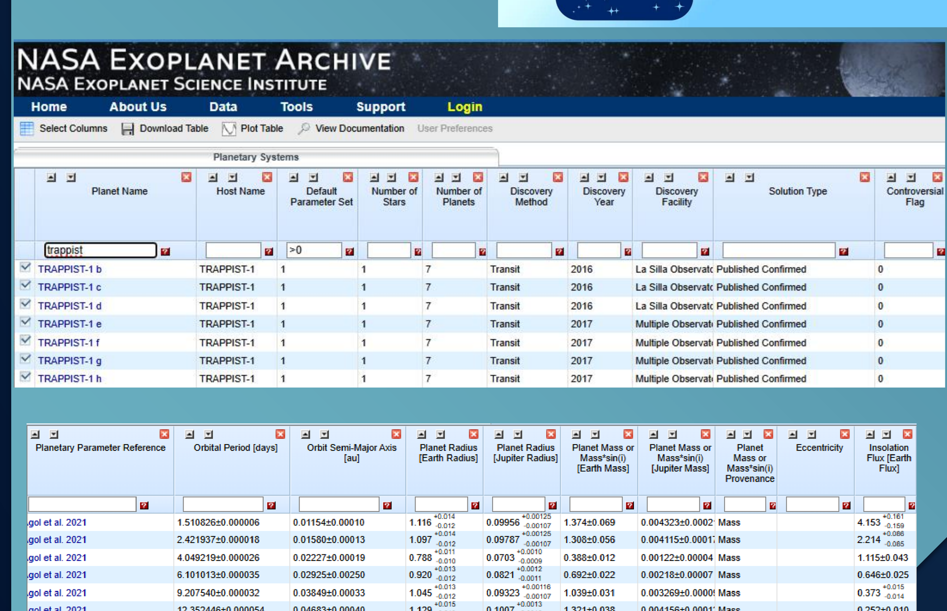
VR becomes a natural response to Gray’s challenge:
give scientists and citizen scientists immersive interfaces to navigate, feel, and interpret complex, high-dimensional data.

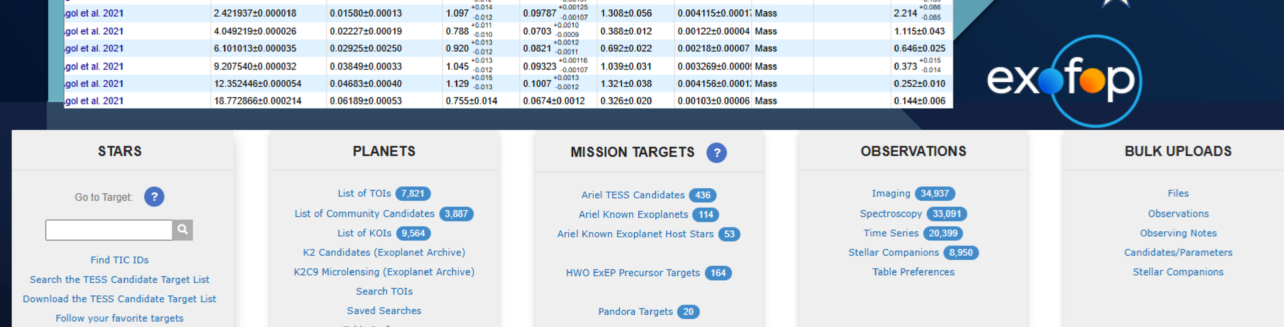
Jim Gray Concept	VR Astronomy Application
Data-intensive science	VR as interface to billion-object catalogs
Federated archives	VO + NExScI + Gaia + AAVSO inside VR
Parallel I/O & streaming	Real-time rendering of million-point star fields
Data cubes	Walkable multi-spectral cubes
Low-barrier querying	Hand-gesture filtering & selection
Provenance	Metadata overlays & citation tracking
Collaboration	Multi-user VR observatories







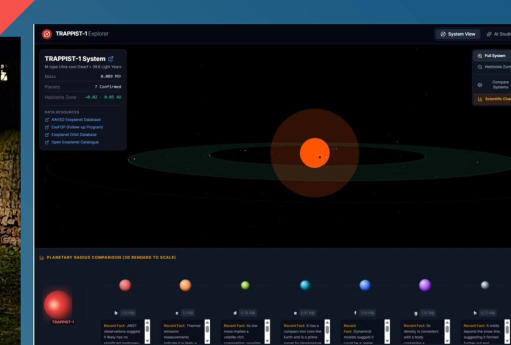




VR/AI

WHAT IS HERE NOW

Navigating Exoplanetary Systems in Augmented Reality: Preliminary Insights on ExoAR



Google AI Studio: Trappist 1 3D using Nano Banana Pro - development time, minutes

Lawton, B., Maurer, F., & Zielasko, D. 2025, in *Advancing Human-Computer Interaction for Space Exploration (SpaceCHI 2025)*, OASIcs, 130, 20, doi:10.4230/OASIcs.SpaceCHI.2025.20

Djorgovski’s contribution has been to push Jim Gray’s data-intensive vision all the way to the human–data interface, pioneering Virtual Observatories, virtual-world laboratories, and commodity-VR tools (iViz/MICA/vCaltech) that turn high-dimensional astro—and exoplanet—surveys into immersive, collaborative discovery spaces.

WHAT IS COMING

Atmospheric Characterization: Moving beyond knowing a planet exists to understanding what it's made of. Scientists are using spectroscopy to detect molecules like water vapor, methane, carbon dioxide, and potentially biosignatures in exoplanet atmospheres. This answers "What are these worlds actually like?"

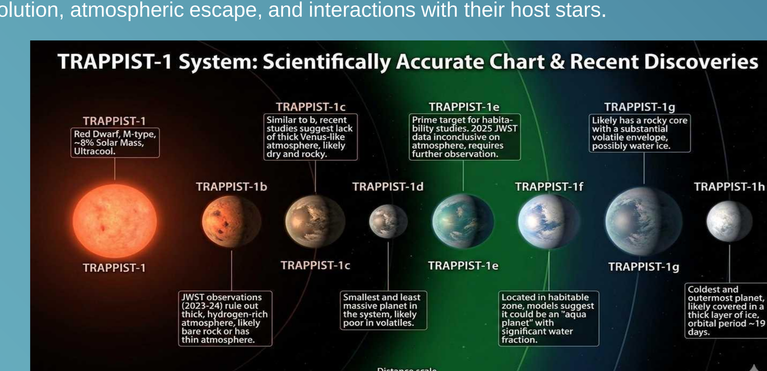
Habitability Assessment: Going deeper than just finding Earth-sized planets in habitable zones to understanding which worlds could actually support life. This involves studying atmospheric chemistry, surface conditions, stellar activity effects, and the stability of potential climates.

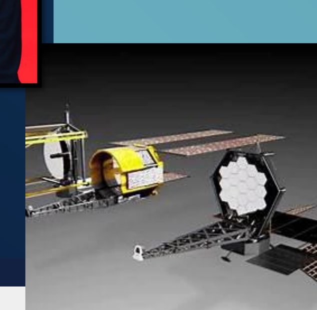
Comparative Planetology: Studying exoplanets as a population to understand planetary system formation and evolution. Why do hot Jupiters exist? How do planetary systems differ from our solar system? This connects individual discoveries to broader theories of how planets form and migrate.

Biosignature Detection: The ultimate frontier—searching for signs of life itself through atmospheric chemistry combinations that suggest biological processes, or even technosignatures from advanced civilizations.

Dynamic Studies: Understanding how these planets change over time—weather patterns, seasonal variations, orbital evolution, atmospheric escape, and interactions with their host stars.

Google AI Studio: Trappist 1 3D using Nano Banana Pro - Slack posting Exoplanet Watch # random Thursday Nov 20, 2025, Ivan Venzor





Like Kepler and TESS before them, data from Roman and the Habitable Worlds Observatory will be available to both the scientific community and the public immediately after processing. With Roman’s surveys expected to deliver a terabyte of data to Earth every day — over 17 times as much as Webb — there is a huge opportunity for the public to help sift through the information.

GAME BUILD

ONE WAY TO PROGRAM IT

Setting Up Meta Quest 3 with Unity 6.3

1. Prerequisites

- Meta Quest 3 headset + USB-C cable / Air Link-capable Wi-Fi
- PC with Unity (version: [your version]) installed
- Meta account and Meta Quest mobile app installed
- USB Debugging & Developer options enabled on the headset

2. Enable Developer Mode

- Create/confirm Meta developer account
- Open Meta Quest mobile app → *Menu → Devices → Developer Mode*
- Toggle **Developer Mode: ON**
- Restart headset if needed

3. Install Required Software

- Install **Unity Hub** and **Unity Editor [currently 6.3]**
- Install **Android Build Support** (Android SDK & NDK, OpenJDK)
- Install **Meta XR / Oculus Integration** from Unity Asset Store or XR packages
- (Optional) Install **ADB drivers** if on Windows

4. Configure Unity Project for Quest 3

- Create **new 3D (URP)** or select template scenes
- Open **Project Settings → XR Plug-in Management**
  - Enable **OpenXR** for Android
- Set **Build Settings → Android** as the target platform
- In **Player Settings**:
  - Company Name, Product Name, Version
  - **Minimum API Level**, **Target API Level** (as required)
  - **Scripting Backend = IL2CPP, ARM64 only**
  - Graphics API (e.g., Vulkan/OpenGLES3 as appropriate)

5. XR & Input Setup

- Install XR Interaction Toolkit / Meta XR SDK as used in your project
- Set OpenXR as active runtime with Meta Quest / Oculus interaction profile
- Add XR Origin / XR Rig prefab to scene
- Configure controllers and hand tracking (if used)

6. Connect Quest 3 to PC

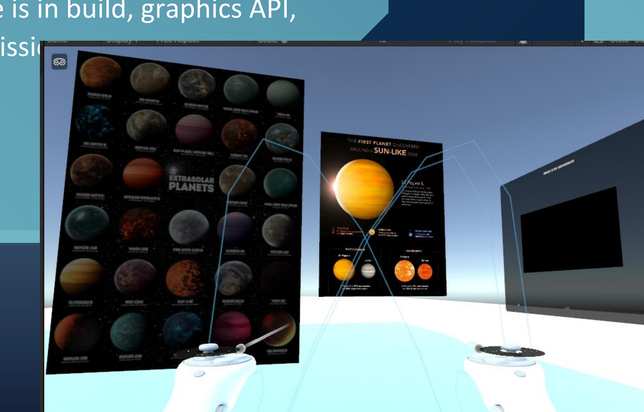
- Put on headset → accept Allow USB debugging? (check “Always allow”)
- In Unity: confirm device appears under Build Settings → Run Device
- (For Wi-Fi / Air Link): pair via Oculus Link / Air Link, then test in Play mode

7. Build & Run

- Open File → Build Settings
- Add current scene to Scenes in Build
- Click Build and Run
- Use SideQuest to deploy APK to Quest 3
- Test in-headset: confirm tracking, controllers, and interaction logic

8. Common Issues & Fixes (Mini Troubleshooting Box)

- Device not found → check USB cable, drivers, Developer Mode, USB debugging
- Build fails → check SDK/NDK installed, ARM64 only, correct OpenXR settings
- Black screen / app closes → verify scene is in build, graphics API, permissi



SURVEY

WHAT WOULD YOU LIKE TO SEE?

ExSoCal

PUBLIC EDUCATION AND CITIZEN SCIENCE