Primordial Photon–Dark Photon Entanglement

A research and analysis framework for testing the **Photon–Dark Photon Entanglement Hypothesis**, analyzing astronomical imaging data, and generating reproducible physics validation results using HST, JWST, and other observatory FITS products.

🚀 Overview

This repository provides:

- **Physics Validation Tests** that compute predicted P–D entanglement observables.
- **Expected Numerical Results** for cross-checking model predictions.
- **Automated pipelines** for running analyses on clusters (e.g., *Abell 1689*) and other astrophysical targets.
- **Jupyter notebooks** for full end-to-end scientific workflows.
- **Data ingestion tools** for MAST/HST/JWST FITS downloads.

Repository Structure

```
Primordial-Photon-Dark-Photon-Entanglement/
├── Physics_Validation_Tests.py
├── Expected_Numerical_Results.py
├── utils/
│   ├── preprocessing.py
│   ├── fits_tools.py
│   └── visualization.py
├── notebooks/
│   ├── Photon_DarkPhoton_Cluster_Analysis.ipynb
│   └── JWST_COSMOS_Advanced.ipynb (optional)
└── README.md
```

🛕 Running Analyses

Quickstart Example (Abell 1689)

```
python run_abell1689_demo.py
```

Outputs include: - Processed maps - Numerical validation results - Metadata JSON - PNGs of reconstructed entanglement signals

A full Jupyter notebook version is included in:

```
notebooks/Photon_DarkPhoton_Cluster_Analysis.ipynb
```

Data Sources Supported

- **Hubble Space Telescope (HST)** via **MAST**
- **JWST NIRCam/MIRI**, including COSMOS-Web
- **MeerKAT / SKA FITS** (optional extensions)
- Any standard FITS file with WCS metadata

🏫Outputs

The pipeline produces: - Entanglement maps - Numerical validation tables - Model deviation/error metrics - Reproducible metadata packages

---

Installation

```
git clone https://github.com/tlcagford/Primordial-Photon-Dark-Photon-
Entanglement
cd Primordial-Photon-Dark-Photon-Entanglement
pip install -r requirements.txt
```

Licensing

This project uses a **Dual-License model**:

- **Commercial License**: Required for for-profit, enterprise, or corporate use.
- **Open Academic & Personal License**: Free for academic research, public study, and personal exploration.

See the `LICENSE` file for details.

Badge:

```
![License: Dual License](https://img.shields.io/badge/license-Dual--License-
blue)
```

Contributing

Pull requests are welcome. For major changes, open an issue to discuss your proposal.

A Contributor License Agreement (CLA) may be required for future releases.

🚋Contact

Author: **Tony E. Ford**
Independent Researcher / Astrophysics & Quantum Systems