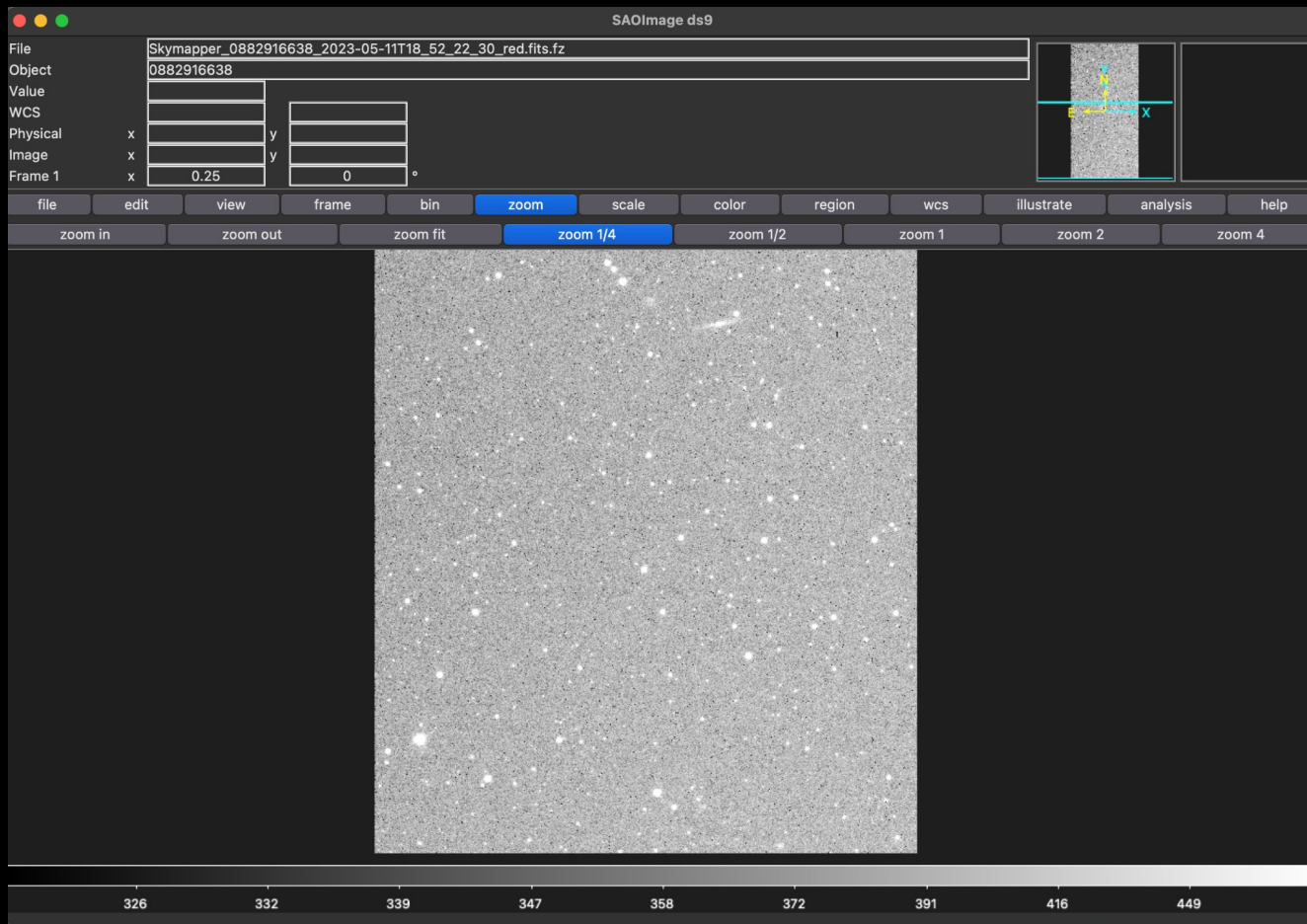# Research Updates Summer 2024

Maryann Benny Fernandes

Week 2

Color: Gray
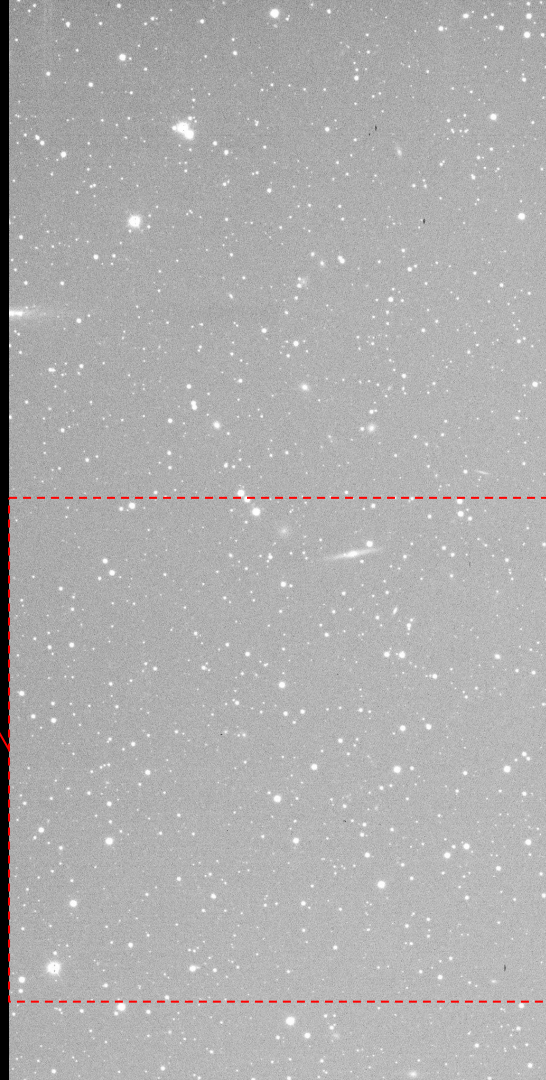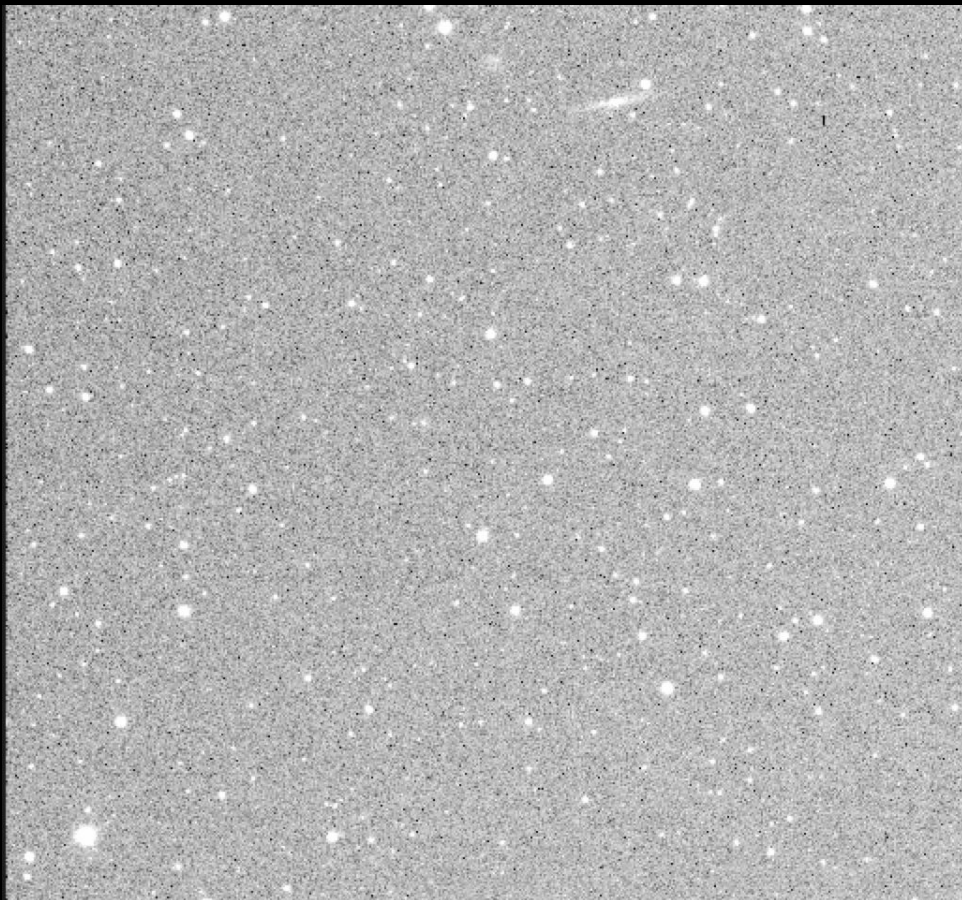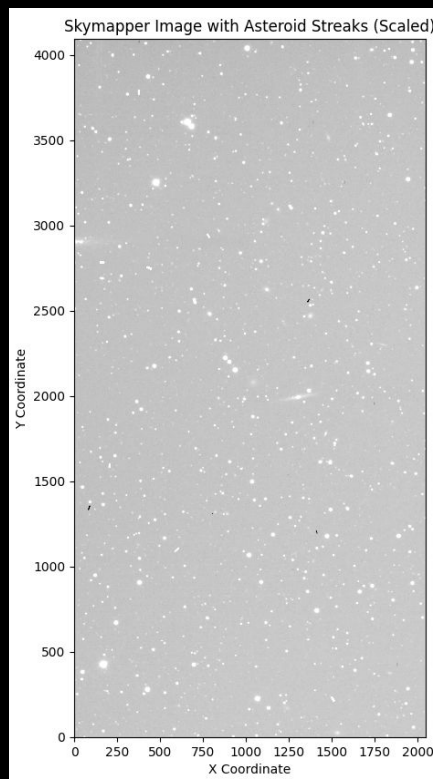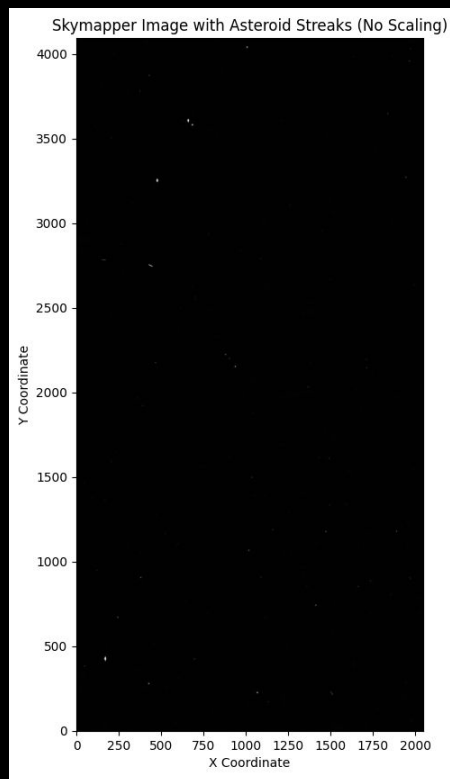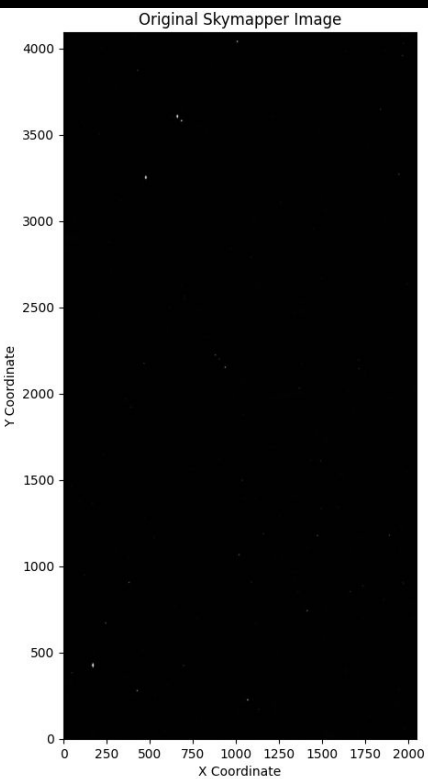
Scale: asinh, zscale
- Asinh: enhances faint and bright features simultaneously

- zscale: Automatic contract adjustment, decreases background dust
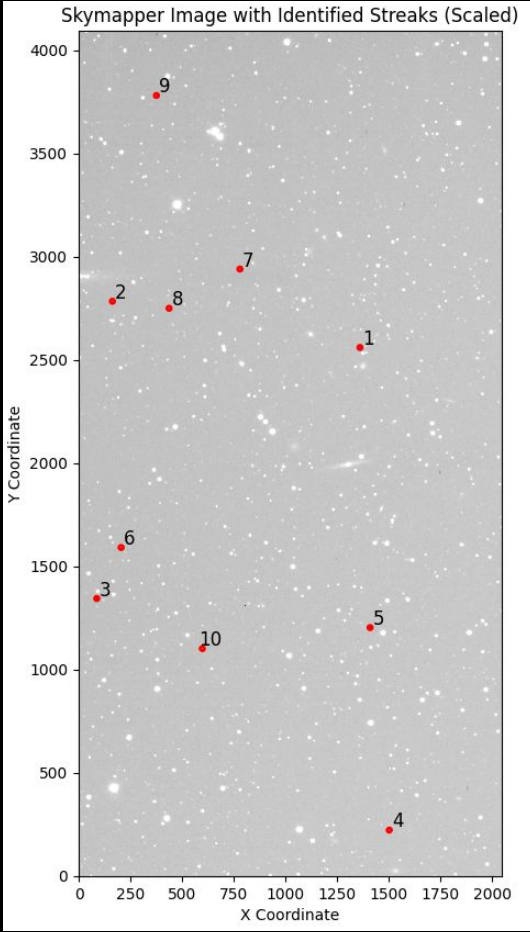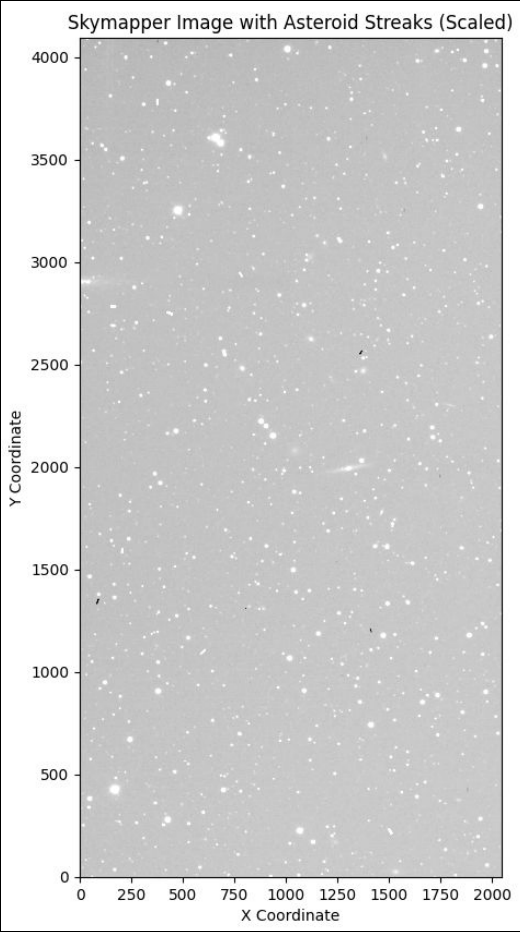
Color: Gray, Scale: zscale, asinh

Adding asteroid streak and scaling

Original Skymapper Image

Skymapper Image with Asteroid Streaks (No Scaling)

Skymapper Image with Asteroid Streaks (Scaled)

Asteroid streaks:

1) Random orientation (0° to 360° (clockwise from east))

2) Random location

3) Random magnitudes from 20-26

4) Random velocity around 1 to 80 arcsec^-1

5) Random width and length (10-20 pixels)

6) Brightness variation not accounted

Identifying asteroid streaks

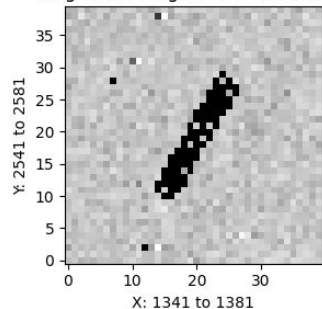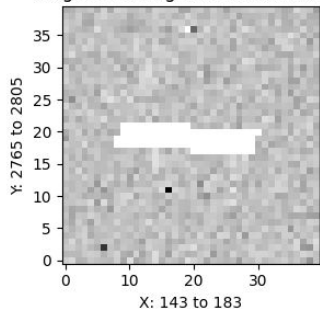Skymapper Image with Asteroid Streaks (Scaled)

Skymapper Image with Identified Streaks (Scaled)

Zooming into features of asteroid streaks

Creating Sub-images and cutouts
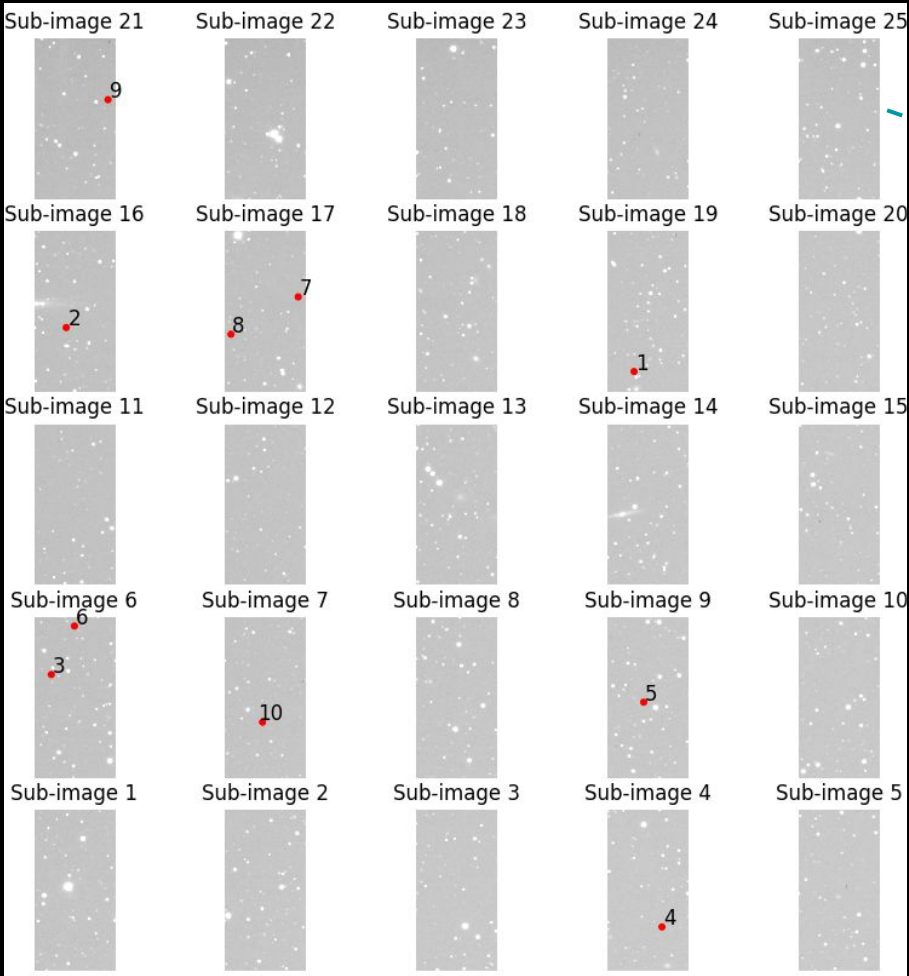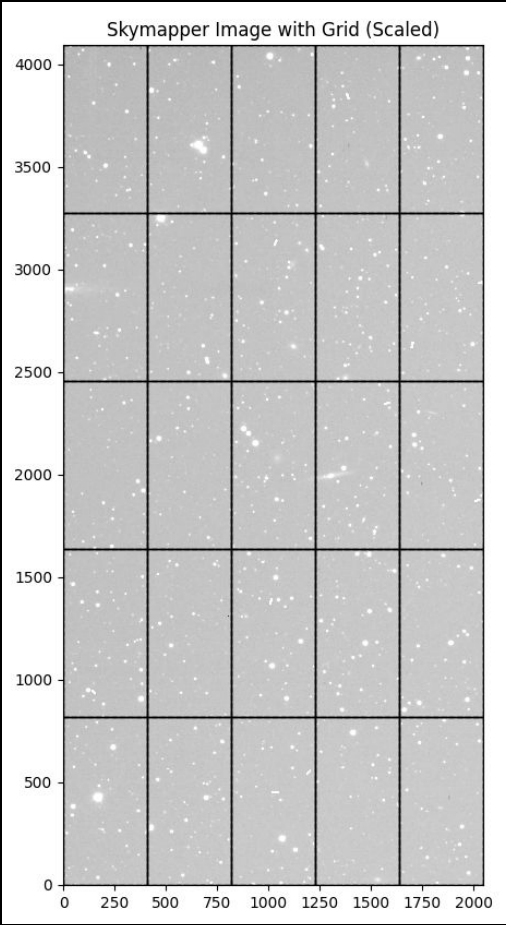
Simulating and Identifying 100 asteroid streaks
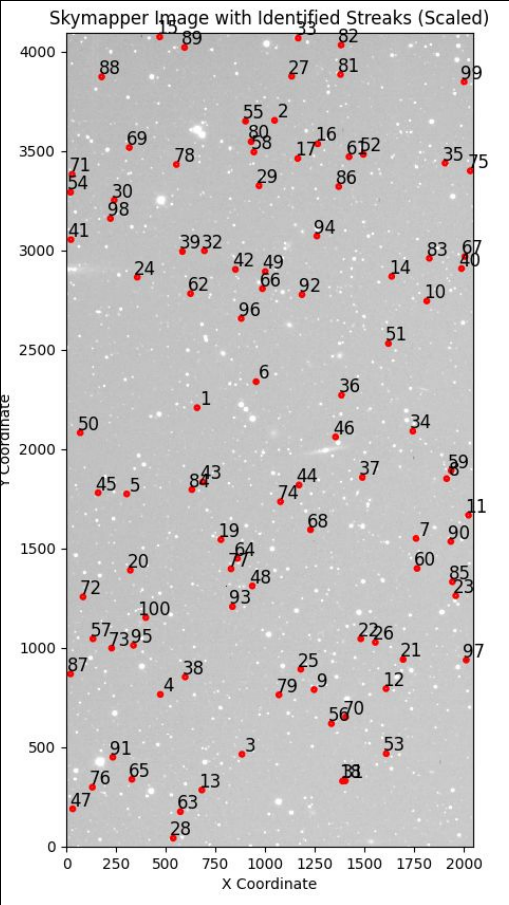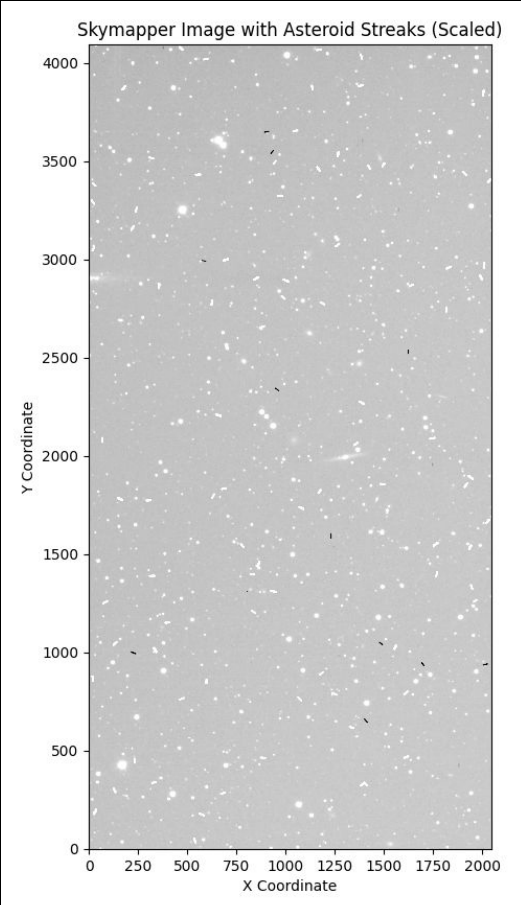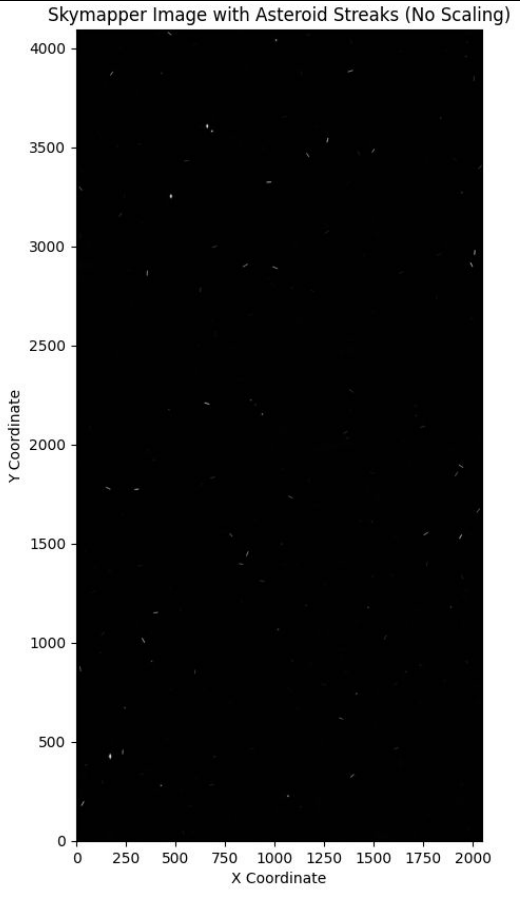
Zooming into features of asteroid streaks
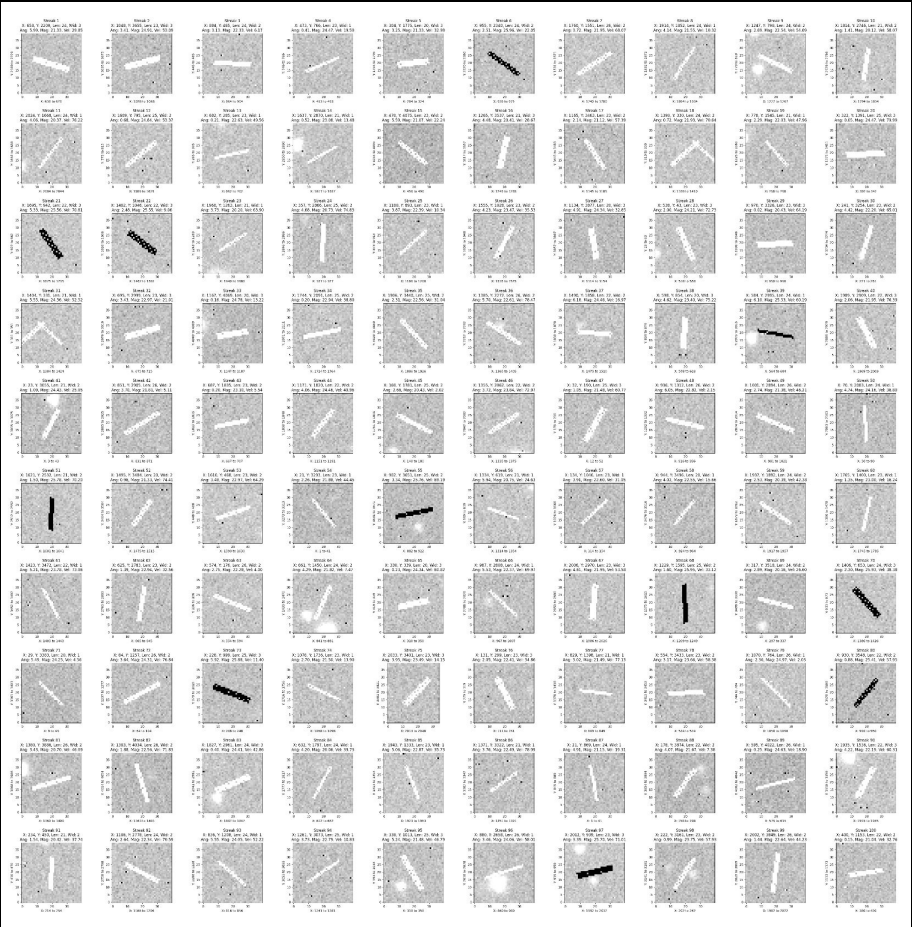
CNN training

CNN testing

Week 1

Week 1: July 19 - 29, 2024

❏ **Received access to [Rubin Science Platform](#), lsst.data.cloud**

   - Studied the notebook tutorial on 'Main Belt Asteroids'

❏ **Studied the asteroid simulation section from the below paper**

   - [Euclid: Identification of asteroid streaks in simulated images using deep learning](#)

   (DL pipeline still need to study)

❏ **Multivariable calculus research assignment and Touch the Art final project on Simulated Asteroids**

Week 2: Goals

❏ Explore the simulated data set on cloud and compare 'Main Belt Asteroids' tutorial with the following by also using the NEA tutorial:

  - New properties of other families in the Main Belt

  - Study objects >1.6 au to see if they make a close approach to Earth or Mars

❏ [Euclid: Identification of asteroid streaks in simulated images using deep learning](#)

  - Understand DL pipeline

Orbital Parameters of SSO's observed ≥ 50 times in 10 years

Celestial body

True anomaly ν

Argument of periapsis ω

Ω Longitude of ascending node

Reference direction ♈

Plane of reference

i Inclination

Ascending node ♎

Orbit

Wikipedia

339864 objects
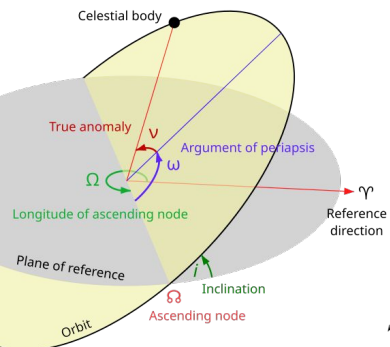
Sin(incl) for 0 to 1 plot

Color Code describes different density levels of objects,
Majority of objects lie below 6 au
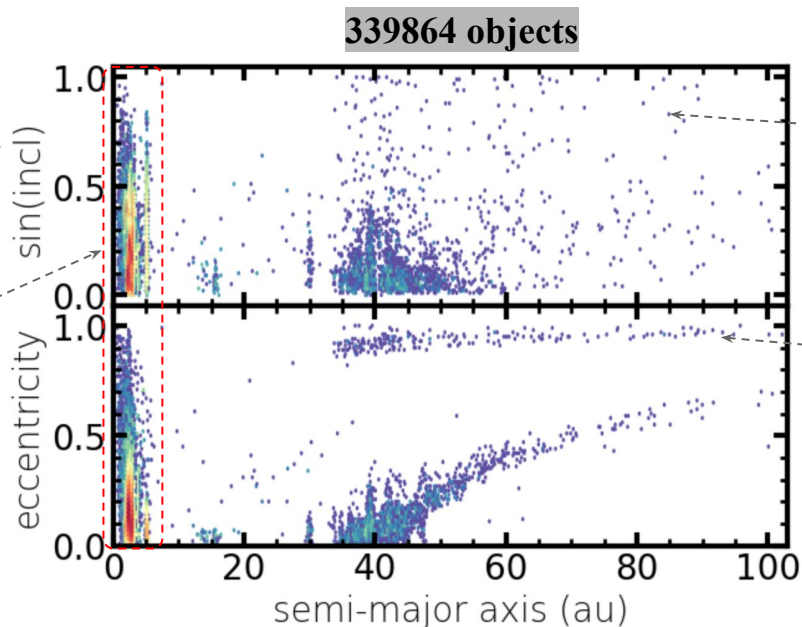
Not many objects have high inclination, must be fairly plane to our Solar System

Objects have high eccentricity so might be comets

Objects go way out of Solar System

Main Belt Asteroids *(1.6 < a < 4.2 au, q > 1.6 au)*

The asteroids of the inner Solar System and
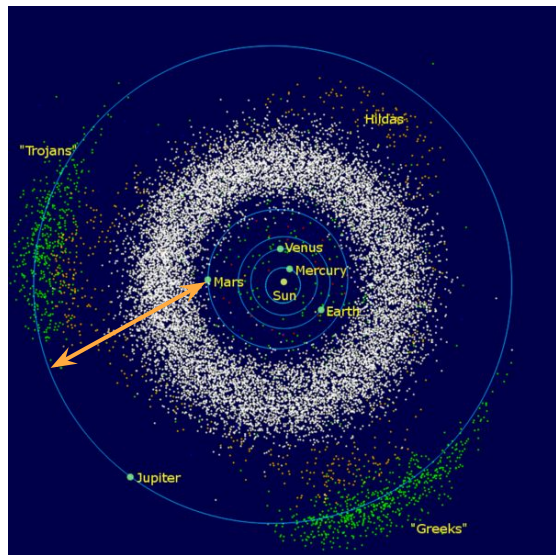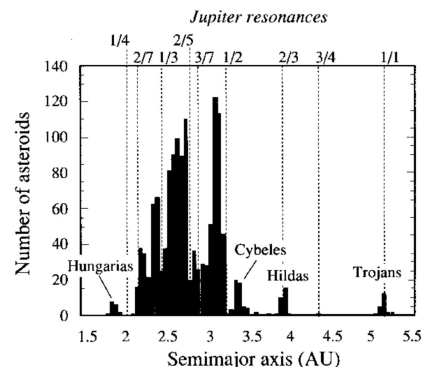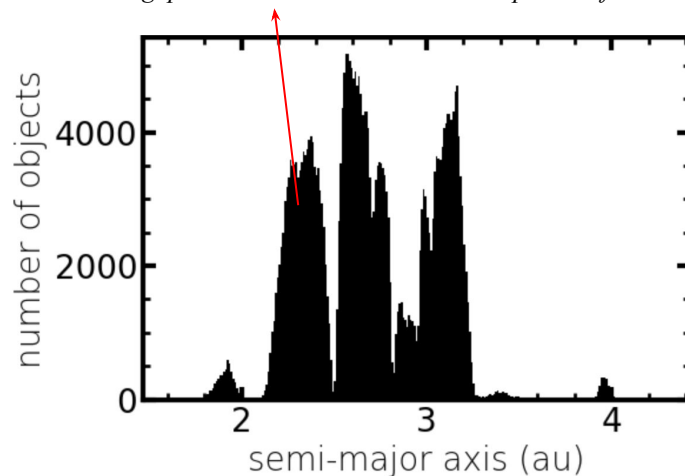Jupiter: The belt is located between the orbits of
Jupiter and Mars.

- Sun
- Jupiter trojans
- Orbits of planets
- Asteroid belt
- Hilda asteroids (Hildas)
- Near-Earth objects (selection)

Wikipedia

Not a uniform Main Belt Asteroid

Kirkwood gaps: Resonances between orbital period of asteroids and Jupiter

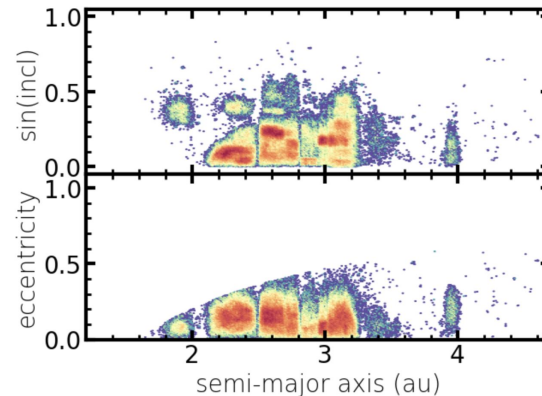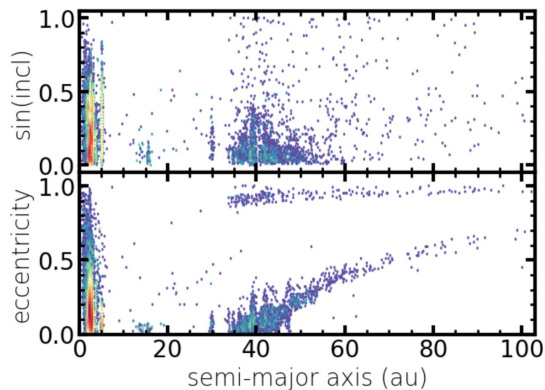Hildas, Cybeles, and Hungarias are
clearly visible in the DP0.3 dataset

http://burro.cwru.edu/Academics/Astr221/Gravity/resonance.html

https://data.lsst.cloud/nb/user/maryann/lab/tree/notebooks/tutorial-notebooks
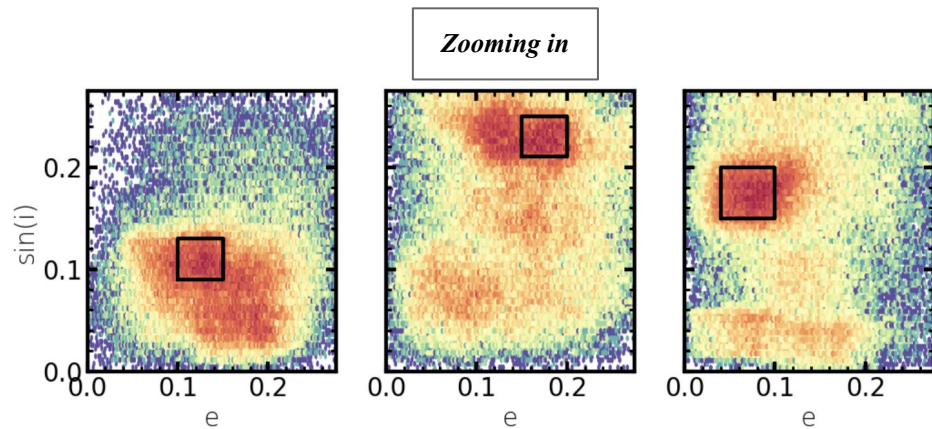
Asteroid Properties in Solar System
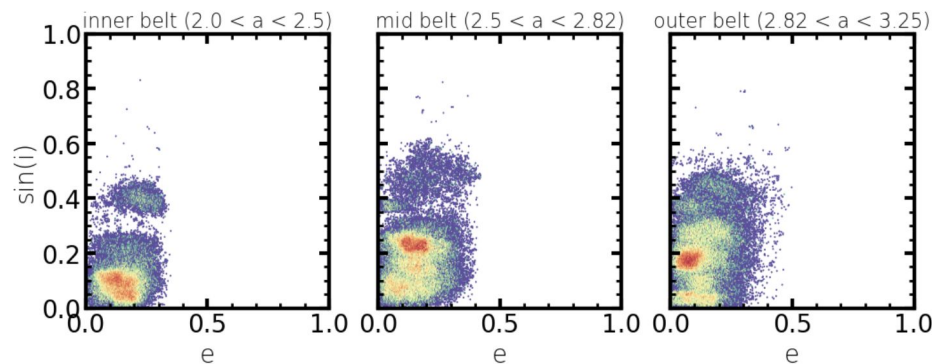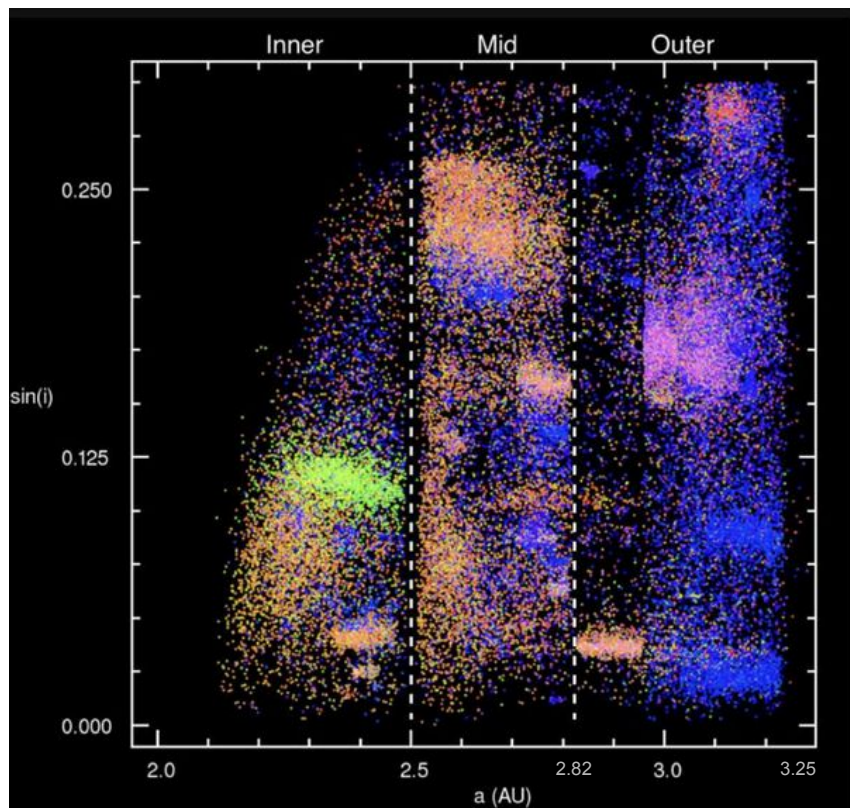
All objects in DP0.3 observed ≥ 50 times in 10 years

All objects in DP0.3 observed ≥ 50 times in 10 years in the Main Asteroid Belt

https://data.lsst.cloud/nb/user/maryann/lab/tree/notebooks/tutorial-notebooks
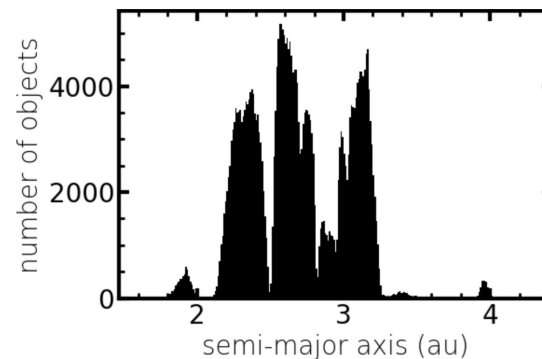
Orbit families in Main Belt Asteroids

https://data.lsst.cloud/nb/user/maryann/lab/tree/notebooks/tutorial-notebooks

Orbit eccentricity and inclination in Main Belt Asteroids
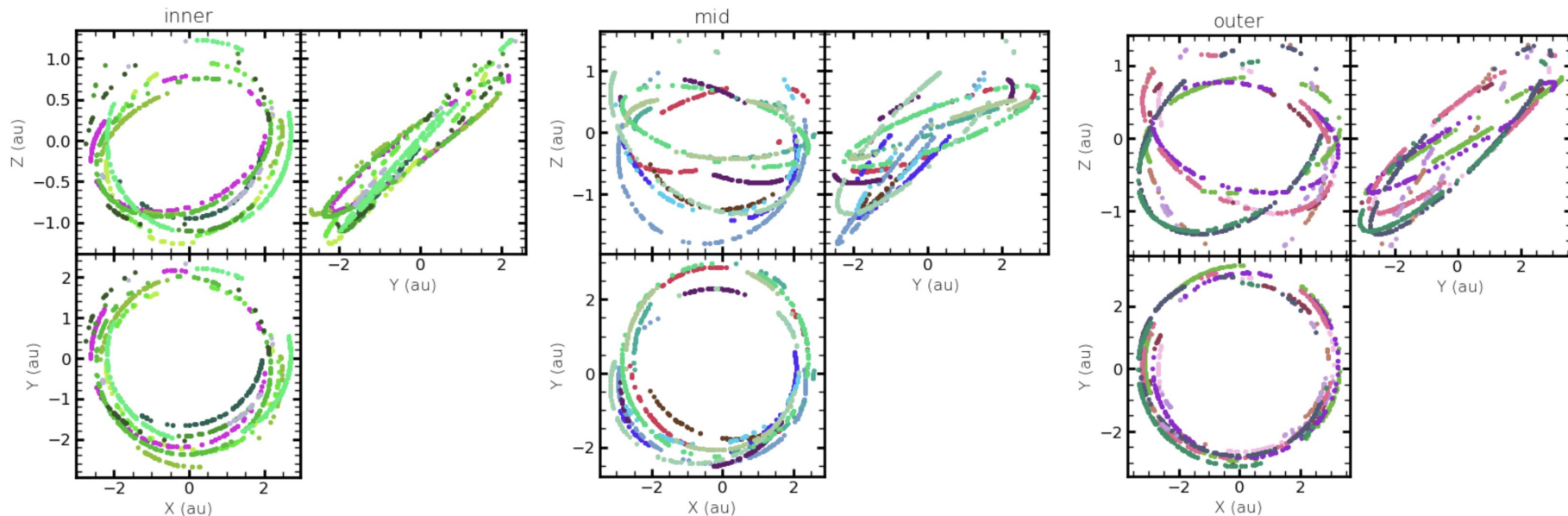
Objects in close proximity to Earth

❏ Earth's eccentricity: **0.0167**

❏ Earth Perihelion distance (closest) to Sun: **0.9832899 AU**

❏ Earth Aphelion distance (farthest) to Sun: **1.0167103 AU**

Objects close-contact with Earth?