VERA C. RUBIN OBSERVATORY

Finding the Unexpected in the Solar System

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Possible surprising discoveries

- New types of objects
- New types of orbits
- New types of behavior
- New associations of objects
- New objects in the solar system (interstellar objects)
- How to find/recognize the unexpected

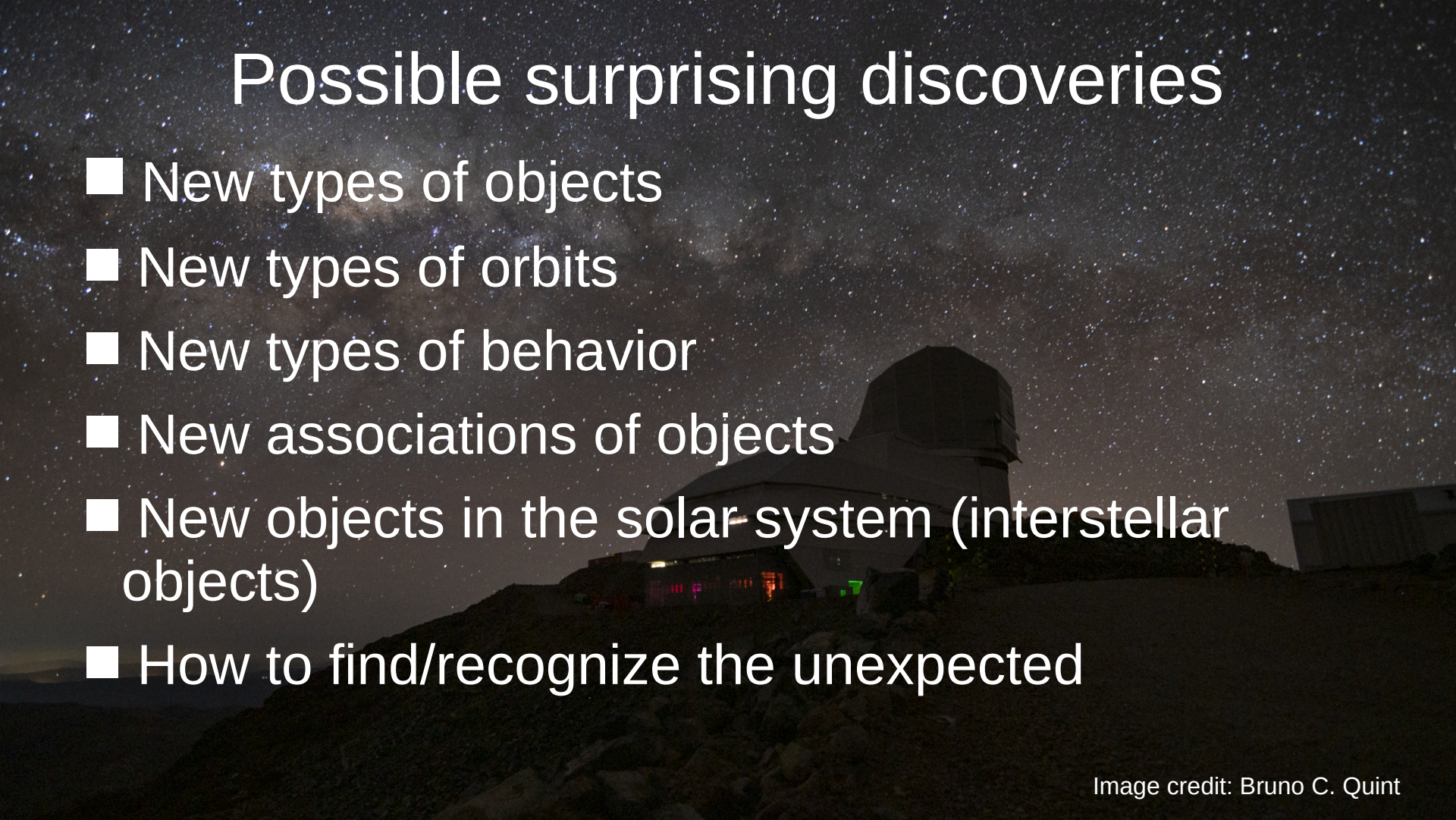


Image credit: Bruno C. Quint

New types of objects

- Unlikely to see objects of an entirely different composition
- Might see new types of fragments from known bodies (e.g., nitrogen icebergs) but still unlikely.

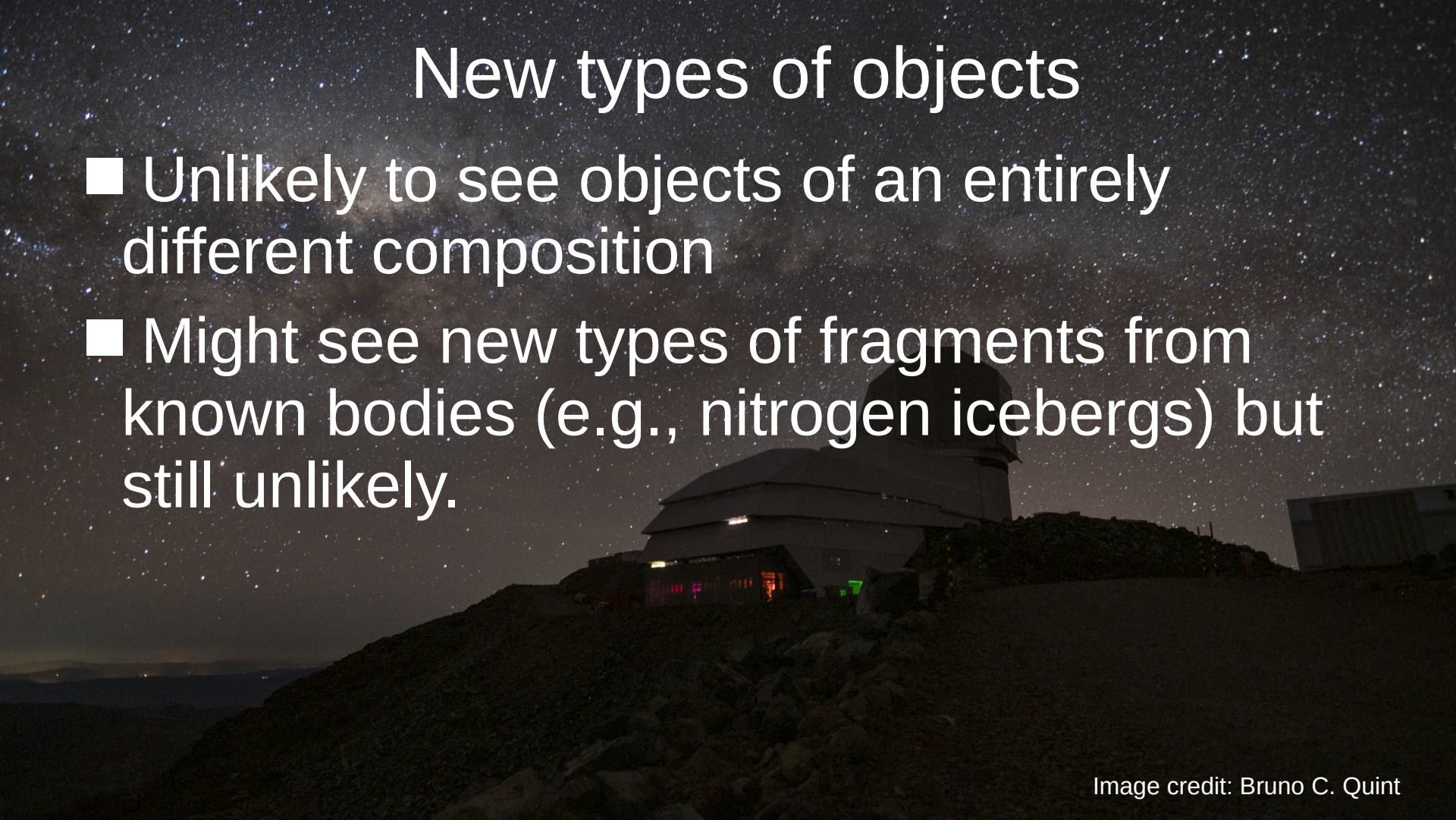
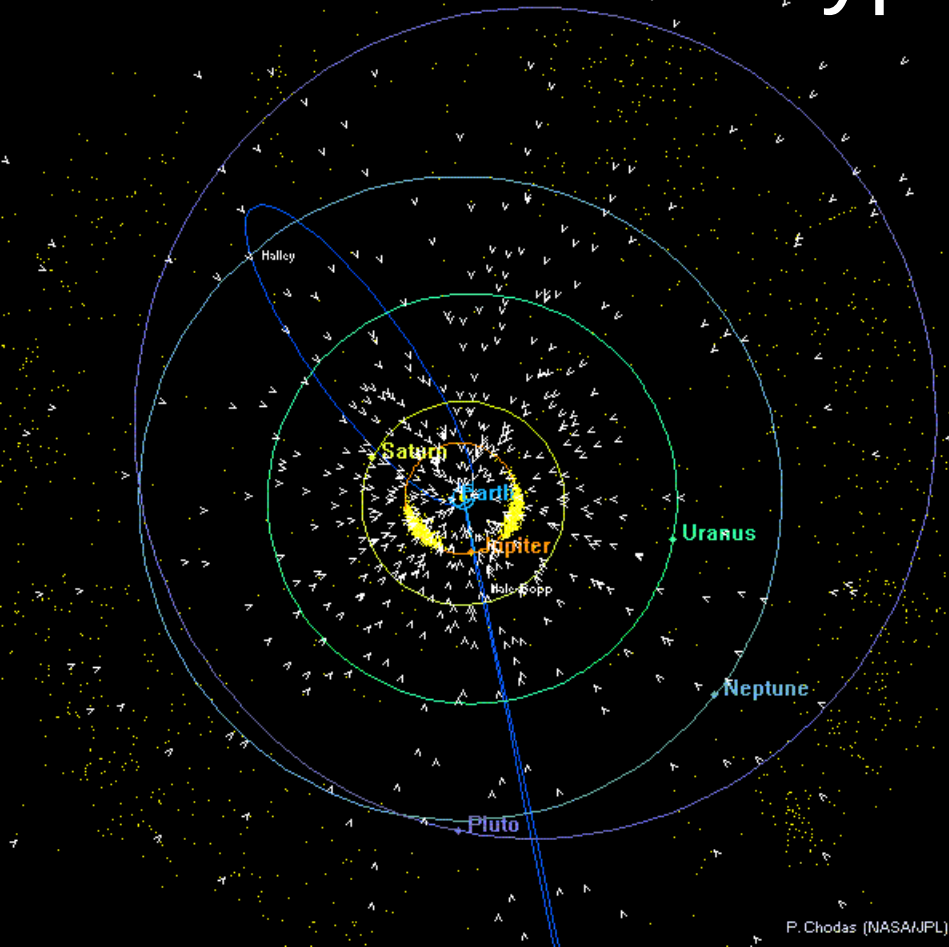
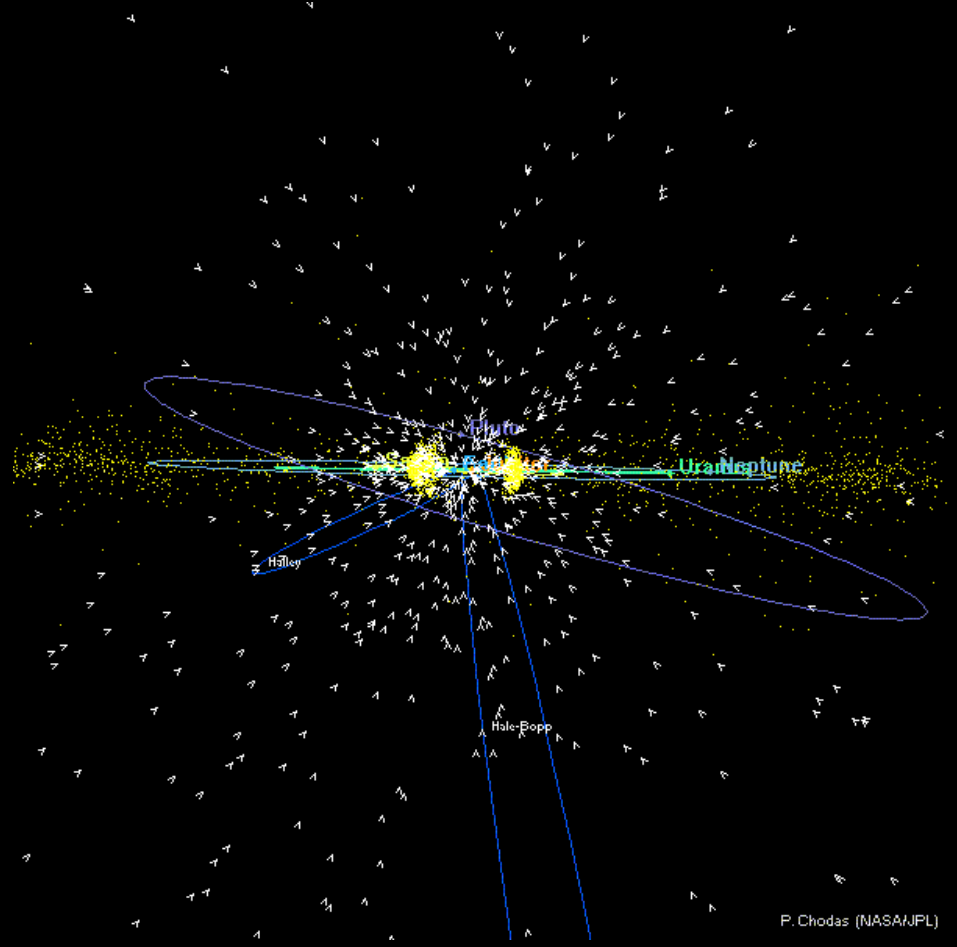


Image credit: Bruno C. Quint

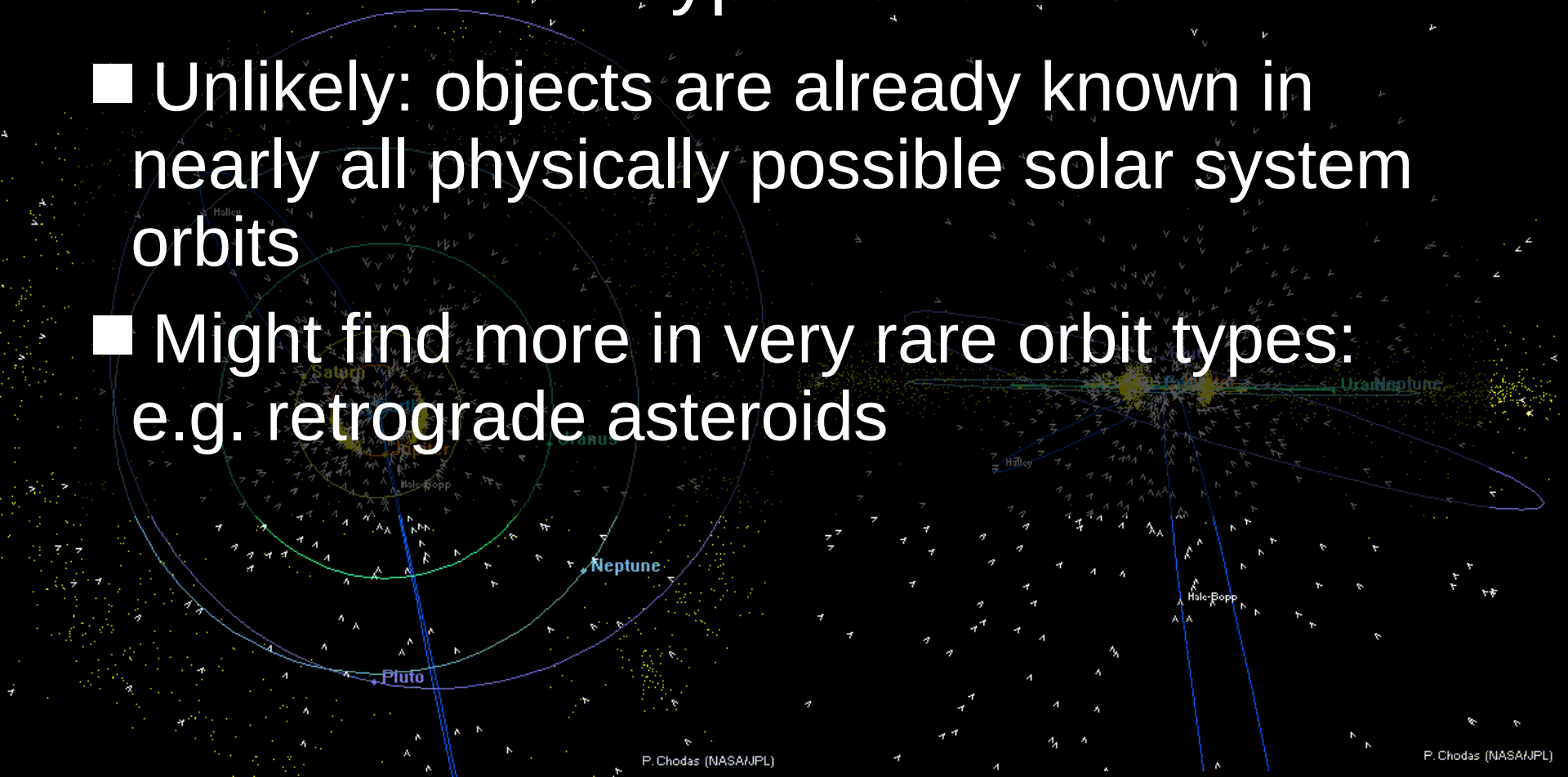
New types of orbits





New types of orbits

- Unlikely: objects are already known in nearly all physically possible solar system orbits
- Might find more in very rare orbit types: e.g. retrograde asteroids



New types of behavior

- Likely – the only question is what type
- Objects suddenly appearing (emission of dust, ??)
- Objects suddenly disappearing (slow, high-amplitude rotation, *clearing* of dust, ??)
- Change in orbit (gas emission, Yarkovsky effect, ??)

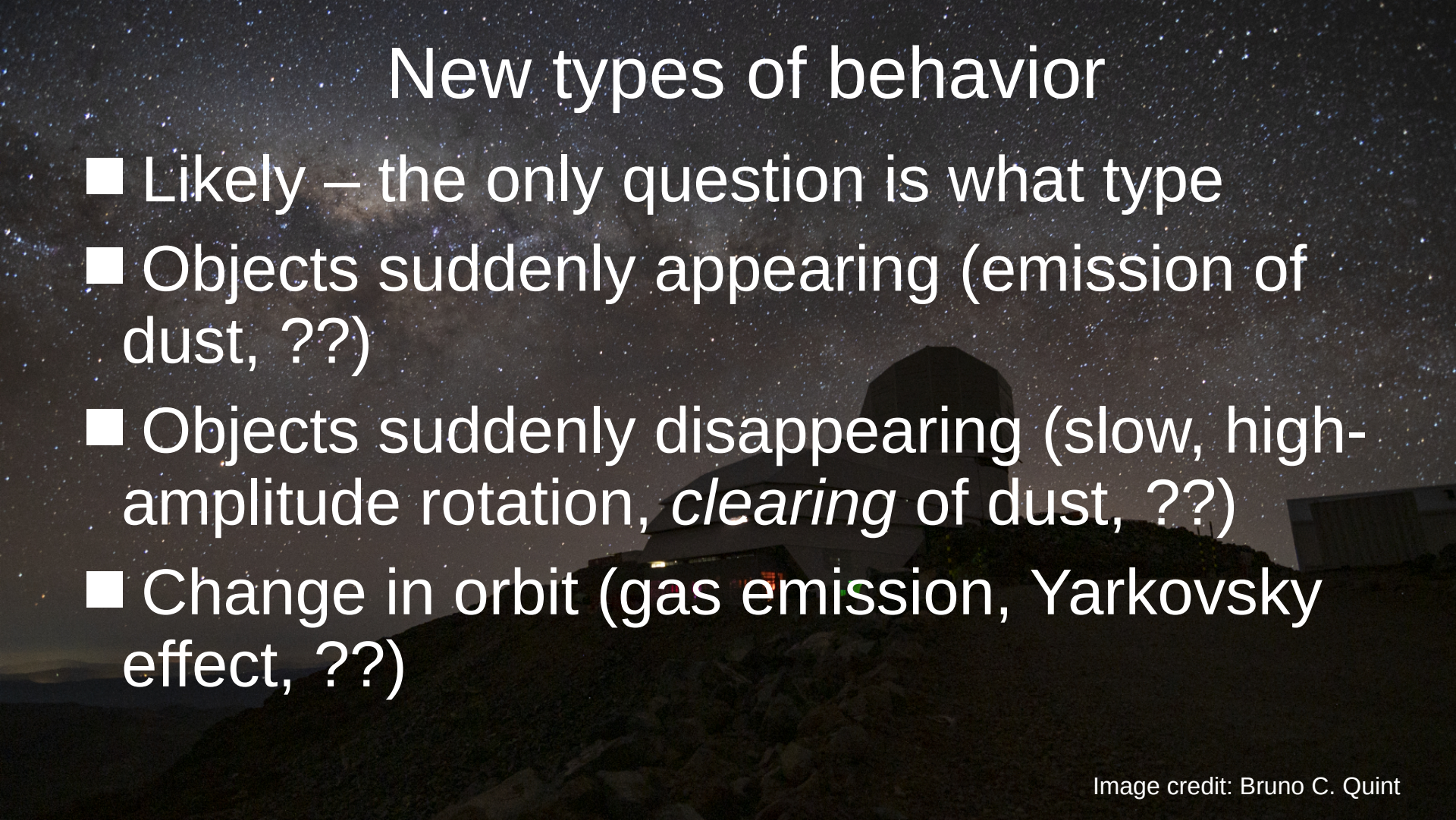
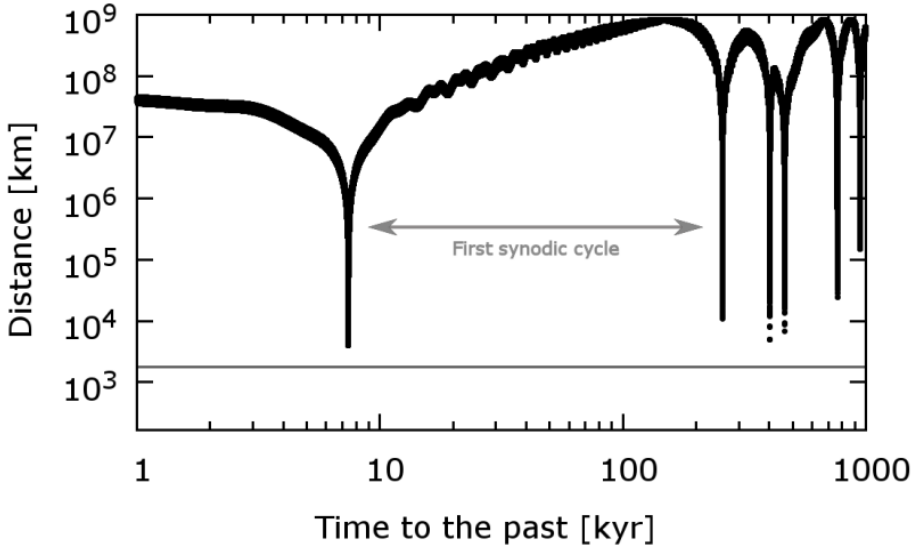


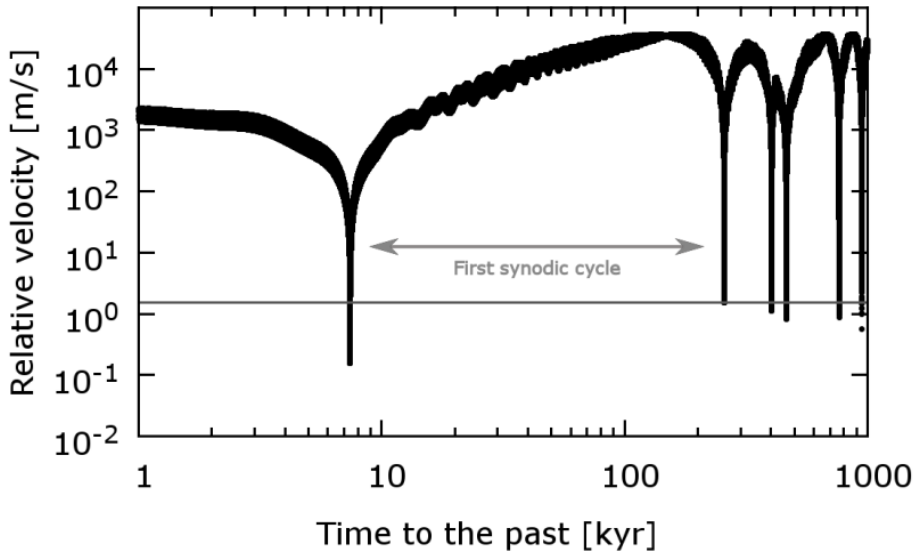
Image credit: Bruno C. Quint

New associations of objects

- **Guaranteed** to be found
- Collisional families in almost the same orbits
- Asteroid pairs from YORP fission
- Will reveal recent exciting events in the asteroid belt
- Will cause me a lot of trouble (but it’s worth it)

New associations of objects





Asteroids 87887 – 415992: the youngest known asteroid pair?

J. Žižka[1], A. Galád[2,], D. Vokrouhlický[1], P. Pravec[3], P. Kušnirák[3], and K. Hornoch[3]

Interstellar objects

- Rates are highly uncertain, but no major obstacle to detection

Image credit: Bruno C. Quint

How to find the unexpected

- Only humans can discover
- Computers can sort through the normal stuff, show us anomalies we should check out
- Experts and beginners may see different things
- Write fast, efficient code
- Search areas of parameter space you know are empty

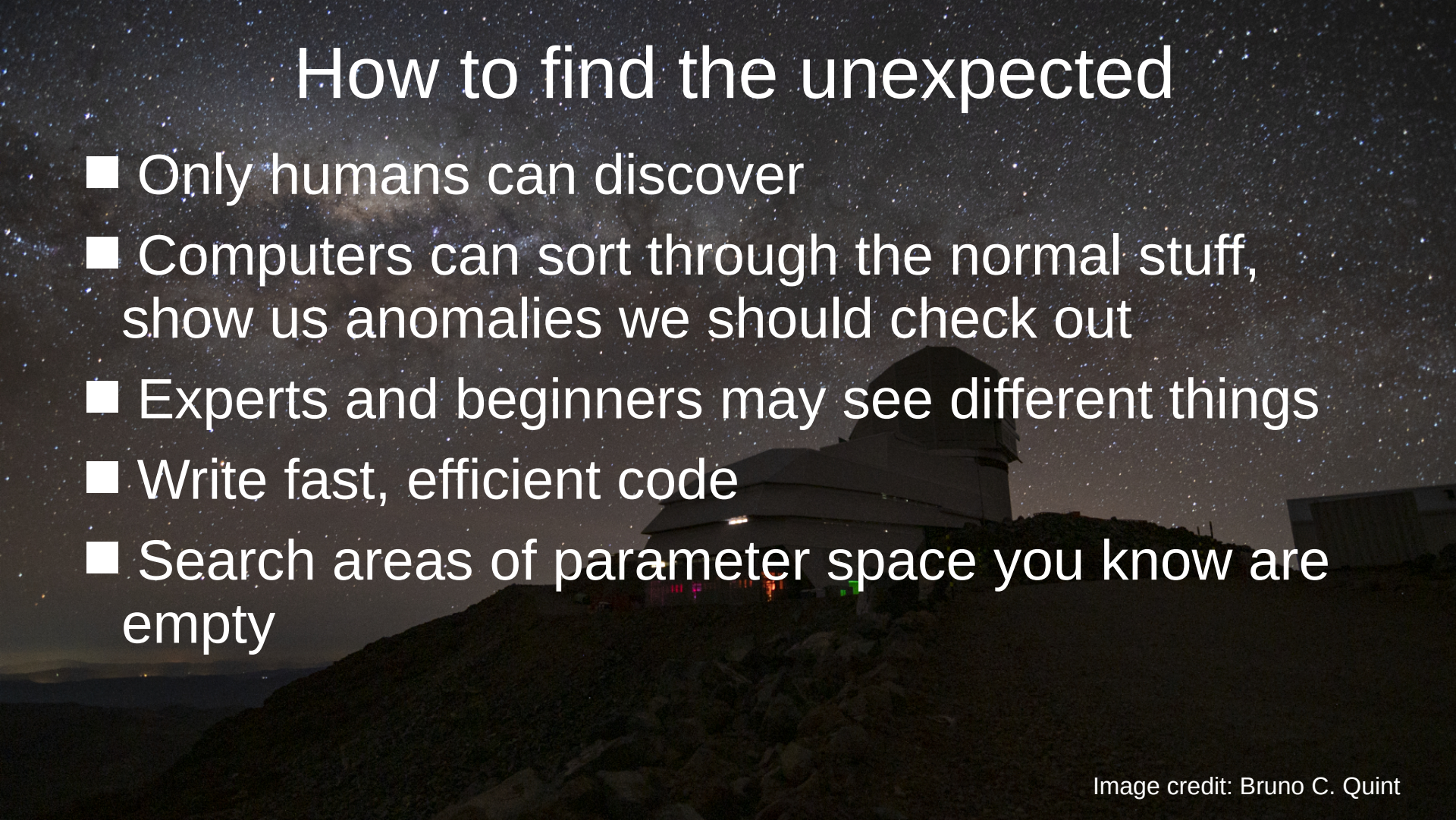


Image credit: Bruno C. Quint