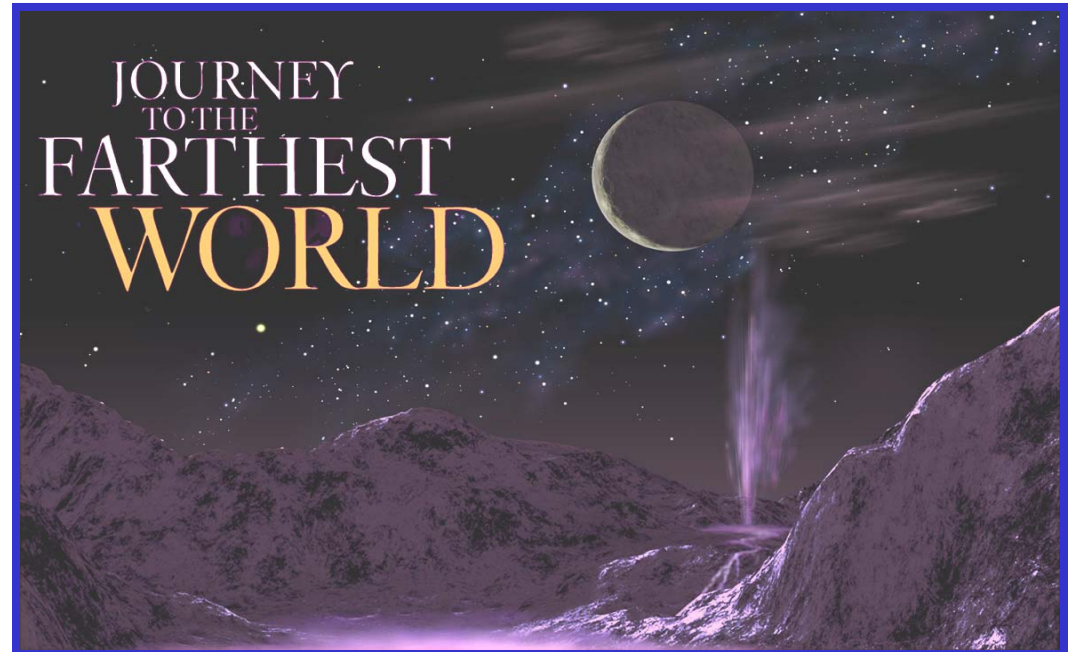
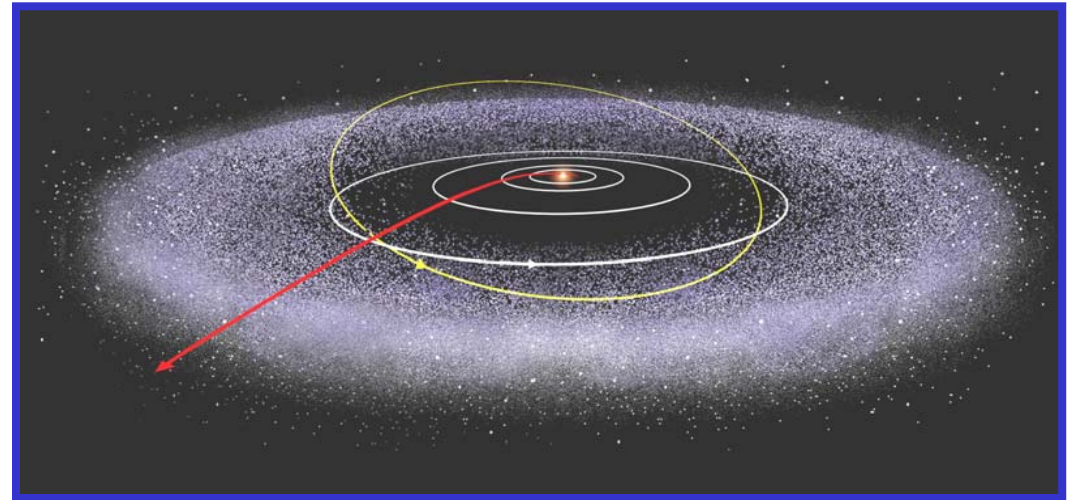


Hal Weaver

Overview of the Science



New Horizons: NASA's Pluto-Kuiper Belt Mission



Dr. Alan Stern: Principal Investigator
Department of Space Studies
Southwest Research Institute

Dr. Hal Weaver: Project Scientist
Space Department
JHU Applied Physics Laboratory



The Solar System's Third Zone: The Kuiper Belt



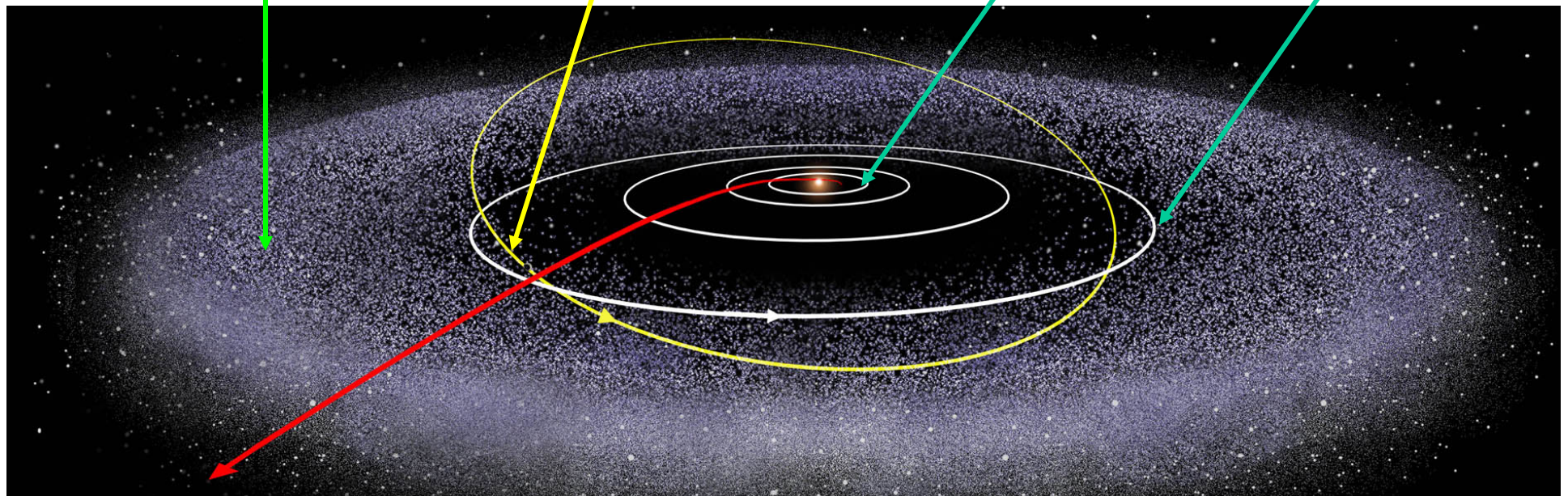
The Kuiper Belt Was Unknown Before the 1990s!

Kuiper Belt

Pluto

Jupiter

Neptune



Pluto and the Kuiper Belt Are Far Away and Difficult to Study, But Scientifically Fundamental to Understanding Our Solar System



Pluto-Charon: A Little Background



PLUTO AND CHARON

PARAMETER	PLUTO	CHARON
ROTATION PERIOD	6.3872 days	6.3872 days
RADIUS	1150 - 1215 km	600 - 640 km
DENSITY	about 2 g/cm ³	1 - 2 g/cm ³
BRIGHTNESS	13.6 magnitude	15.5 mag
GEOMETRIC ALBEDO	0.55, variable	0.32
COLOR (V-I)	0.93 magnitude	0.83 mag
KNOWN SURFACE ICES	CH ₄ , N ₂ , CO, ?	H ₂ O, ?
ATMOSPHERE	CONFIRMED	DOUBTFUL

PLUTO

Buie, Tholen and Home [1992]



Young and Binzel [1993]



2 Models → similar large features

Interpretation:

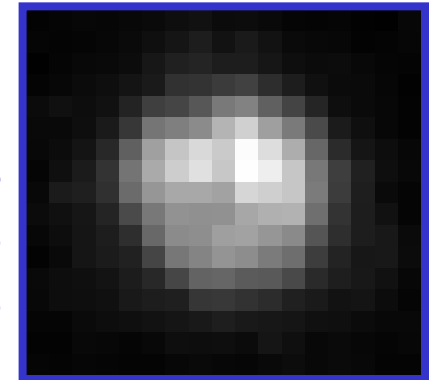
- Spotty object
- Light areas - fresh frost
- Dark areas - dirty ice or rock
- Asymmetric polar caps

Unknown:

- Details on scales < 500 km



The Best Hubble
Images of Pluto
Are Still Crude





Pluto & Charon: Small, But Unique in Three Important Ways



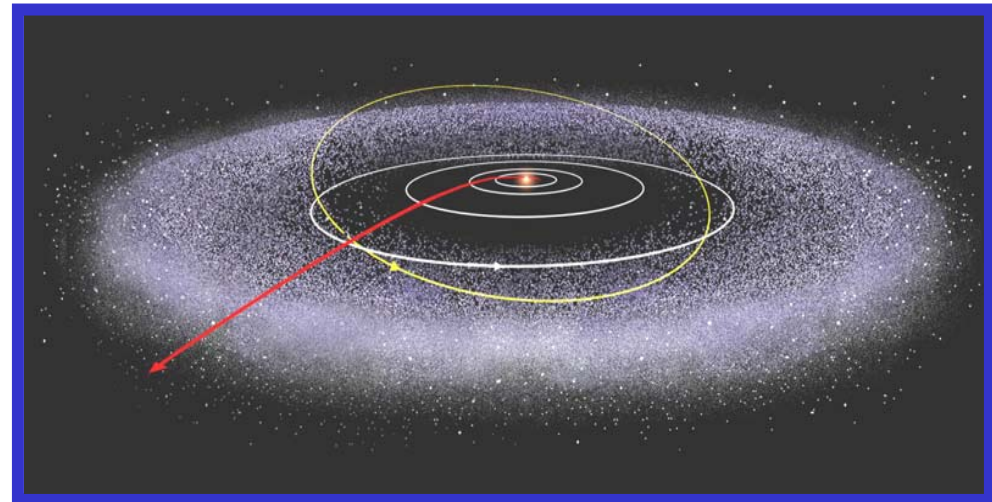
- ❑ Pluto and Charon are neither Terrestrial Planets nor Gas Giant Planets: They belong to a wholly new type of body, *Ice Dwarfs*, which are common to the deep outer solar system, a region not yet explored.
- ❑ Pluto-Charon is the solar system's *only known Binary Planet*, with important implications for understanding the formation of the Earth-Moon system.
- ❑ Pluto's *Rapidly Escaping Atmosphere* is a transitional case between a cometary and a classical planetary atmosphere, and is the only expected site of planetary hydrodynamic escape that occurred on the early Earth.



Tracing the Origin and Evolution of the Solar System



- ❑ Pluto's and Charon's surfaces record the details of outer solar system bombardment history, leading to an improved understanding of the rate at which Earth impacts occur.
- ❑ The Kuiper Belt is the best known "archeological site" to explore mid-stage accretion in the outer solar system.
- ❑ The Kuiper Belt is the source of the short-period comets, which seeded the Earth with water and organic chemicals.

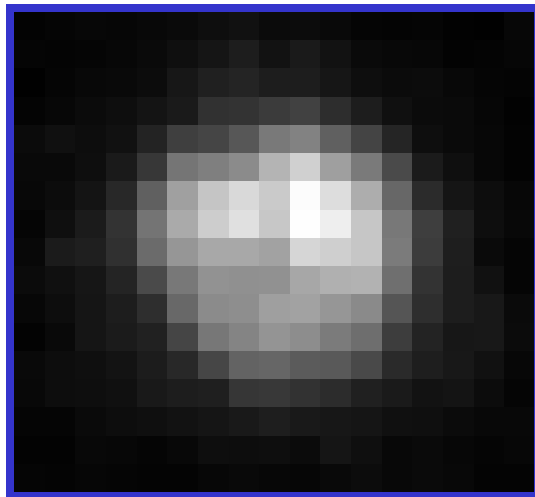




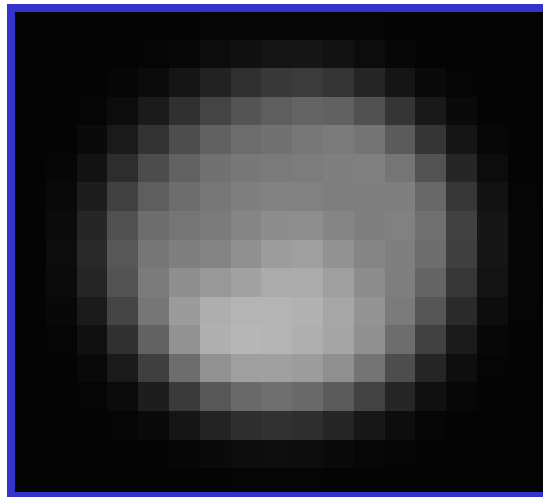
But Progress Will Be Limited *Until We Visit*



*This is the fundamental historical lesson
of planetary exploration.*



**Pluto at best
Hubble Resolution**



**Earth's Moon at the
Same Resolution**



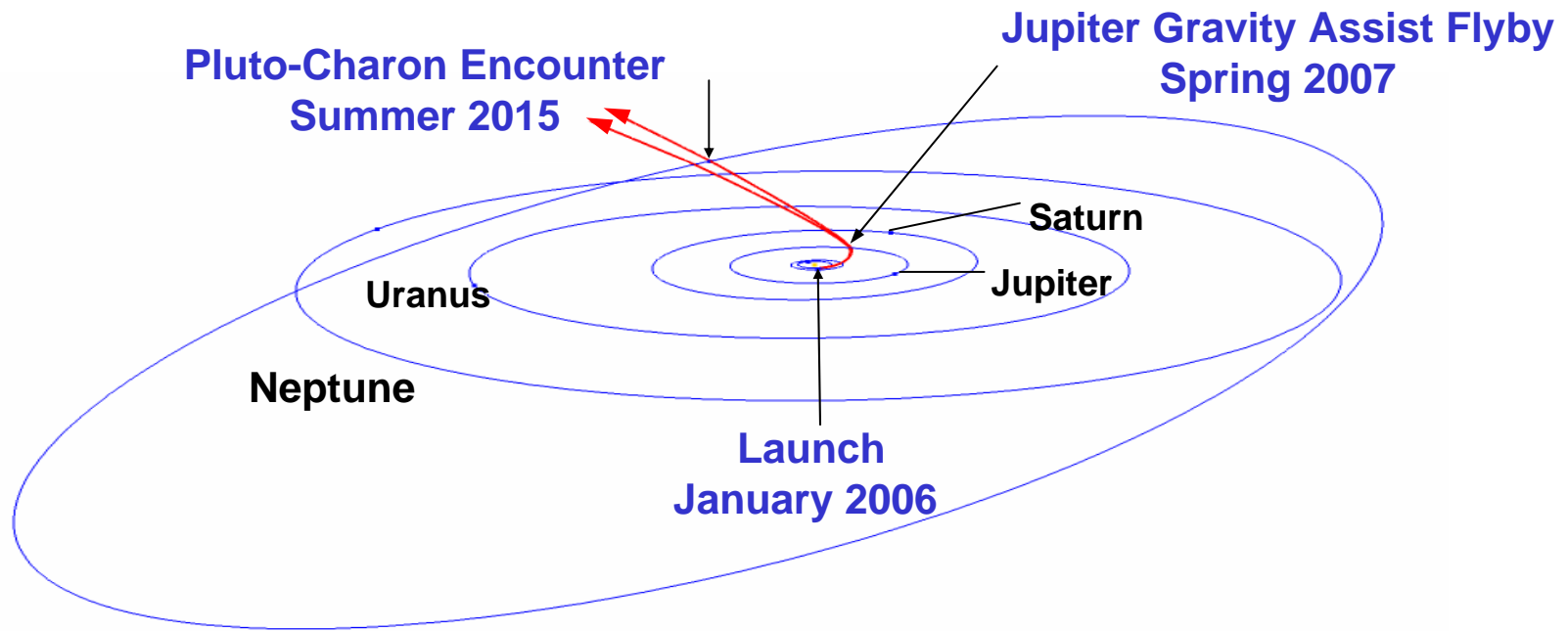
**Earth's Moon at
5 km per pixel**



Why Go to Pluto Now?



Mission Trajectory



Time-Criticality Factors:

- JGA Pluto trajectory is available in 2006 but, after that, not until 2018.
- Atmospheric collapse probability increases with time.
- Pluto's approaching winter solstice nightfall costs $\sim 200,000 \text{ km}^2/\text{yr}$



New Horizons: An Historic Journey



**The First Mission to Explore The Solar System's
"Third Zone" and "The First Mission to the Last Planet"**

***A Reconnaissance Expedition to the Kuiper Belt and
Pluto-Charon: Recommended as the Highest Priority
Mid-Size Mission by the National Research Council's
Planetary Decadal Survey (2002)***





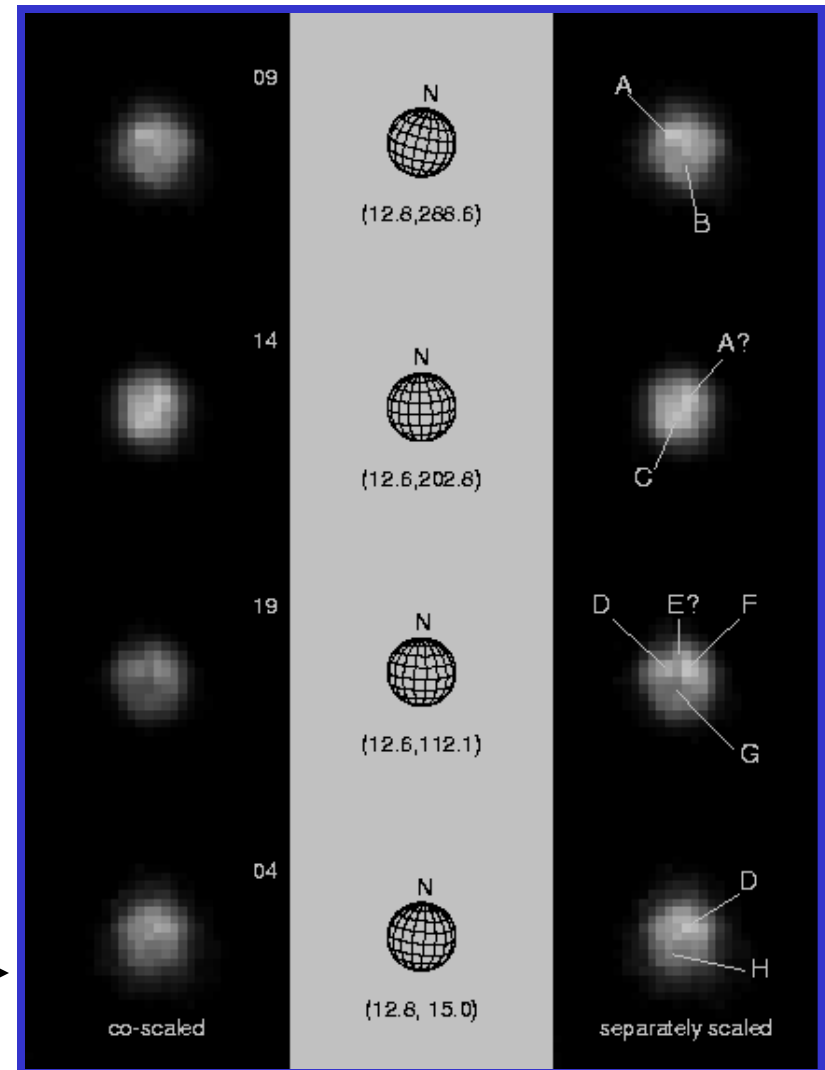
Pluto-Charon Science Highlights



- Six months of encounter science.
- Exceed Hubble resolution for months!
- Map entire sunlit surfaces of Pluto and Charon.
- Make global composition maps of Pluto and Charon.
- Map the surface temperatures of Pluto and Charon.
- Directly measure the escape rate and composition of Pluto's atmosphere.

The most exciting discoveries will probably be the ones we can't even anticipate!

Hubble's Best Pluto Images →





Unexplored Territory



We Plan to Make This 1990 U.S. Stamp Obsolete!

