

New Horizons **in the Kuiper Belt:** *Discovering How Planetary* *Building Blocks Form*

February 13, 2020

American Association for
the Advancement of Science

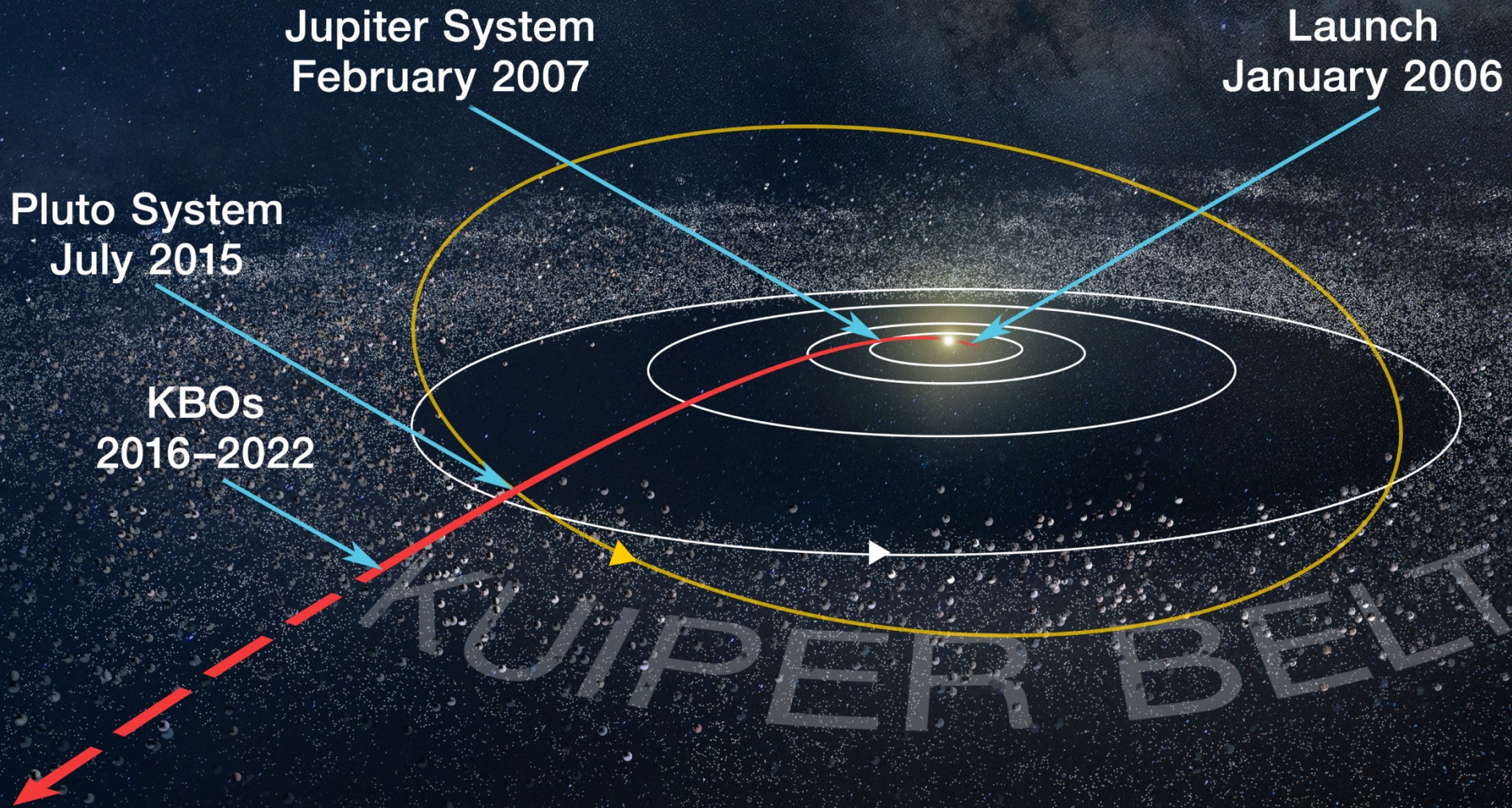


Exploring Kuiper Belt Objects

Dr. Alan Stern

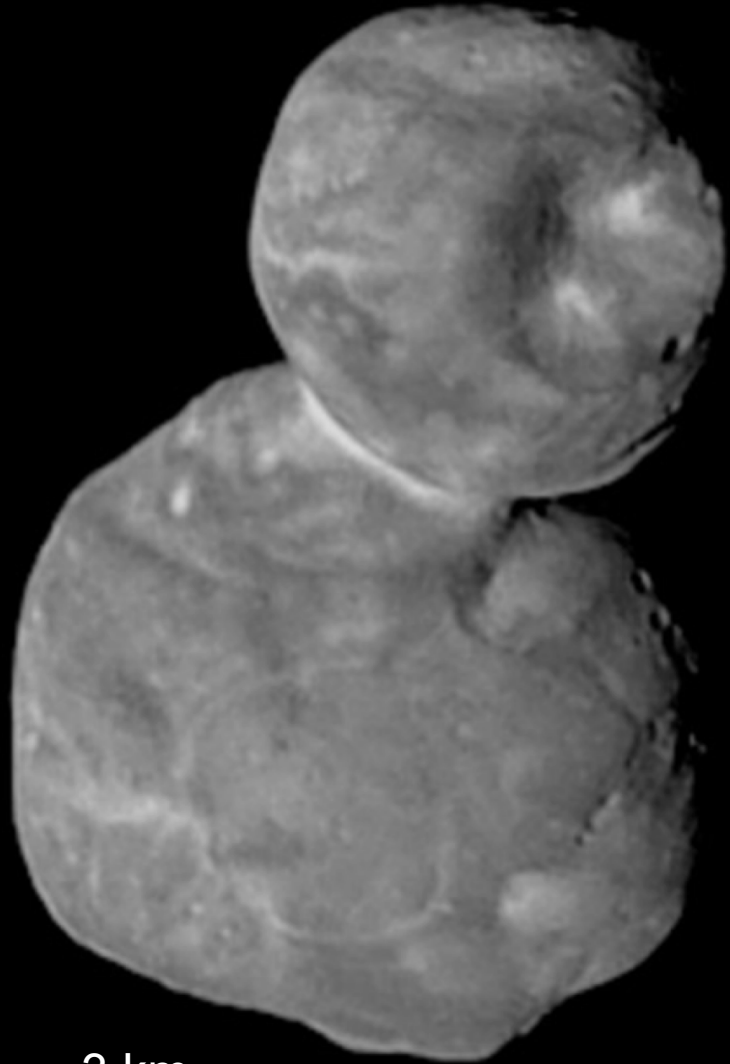
New Horizons Principal Investigator
Southwest Research Institute







Arrokoth (KBO)

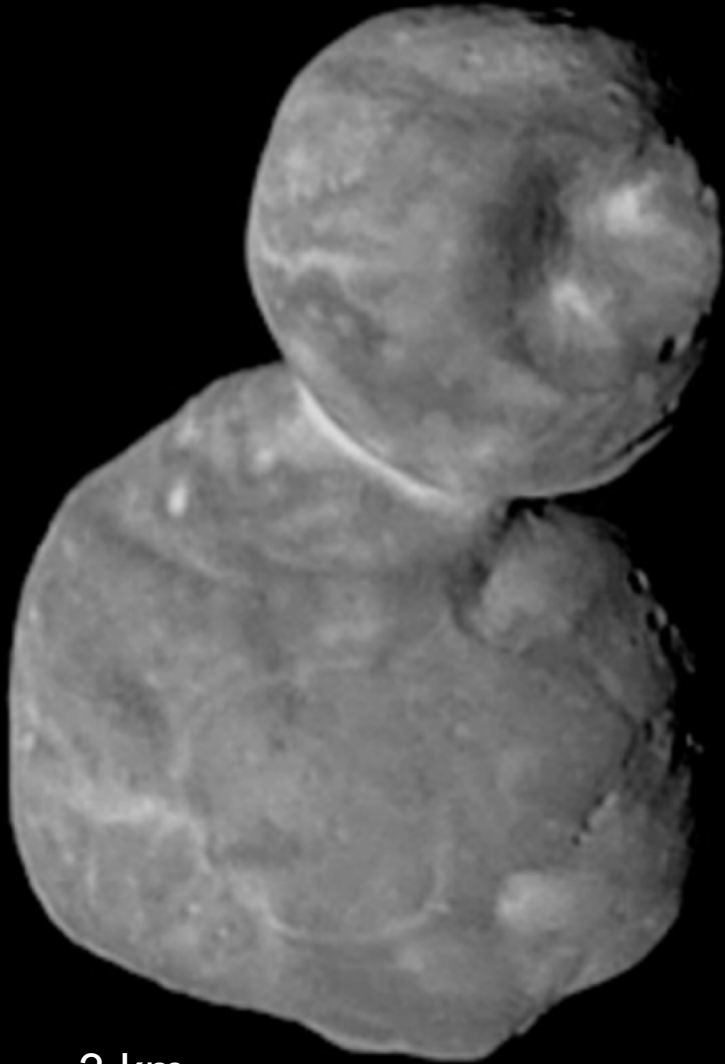


3 km



1.9 mi

Arrokoth (KBO)



Ida (Asteroid)



67P C-G (Comet)



3 km
1.9 mi

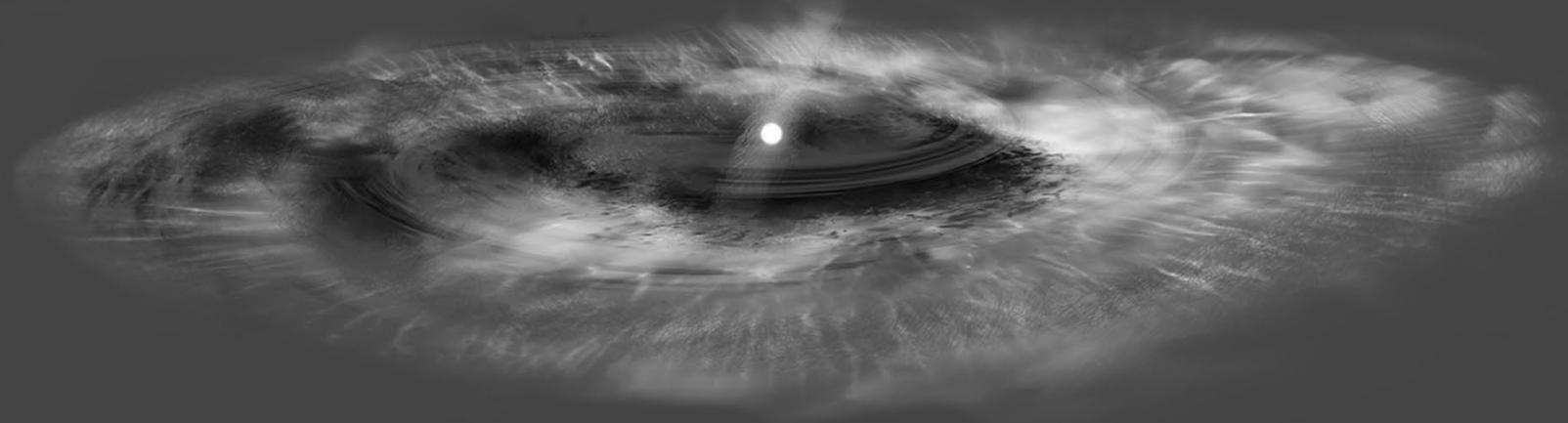
3 km

3 km

Discovering How Planetesimals Form

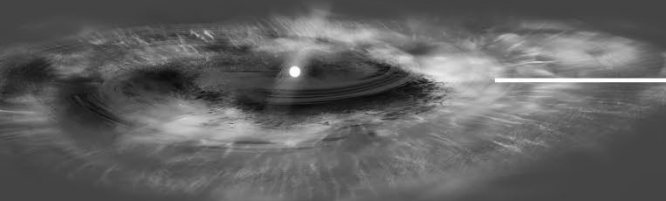
Dr. William McKinnon
New Horizons Co-Investigator
Washington University in St. Louis

How Do Planetesimals Form?



Protosolar disk

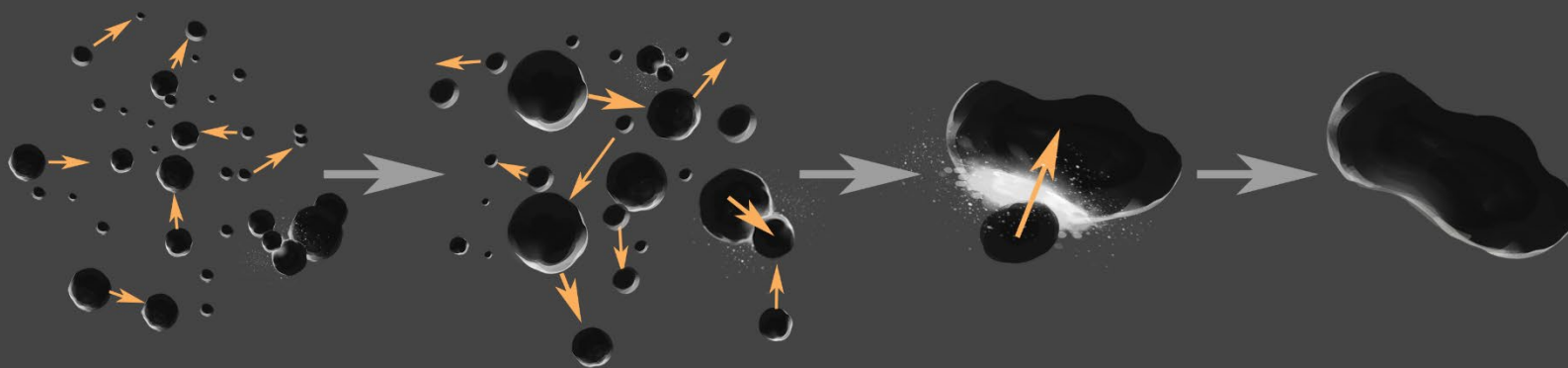
How Do Planetesimals Form?



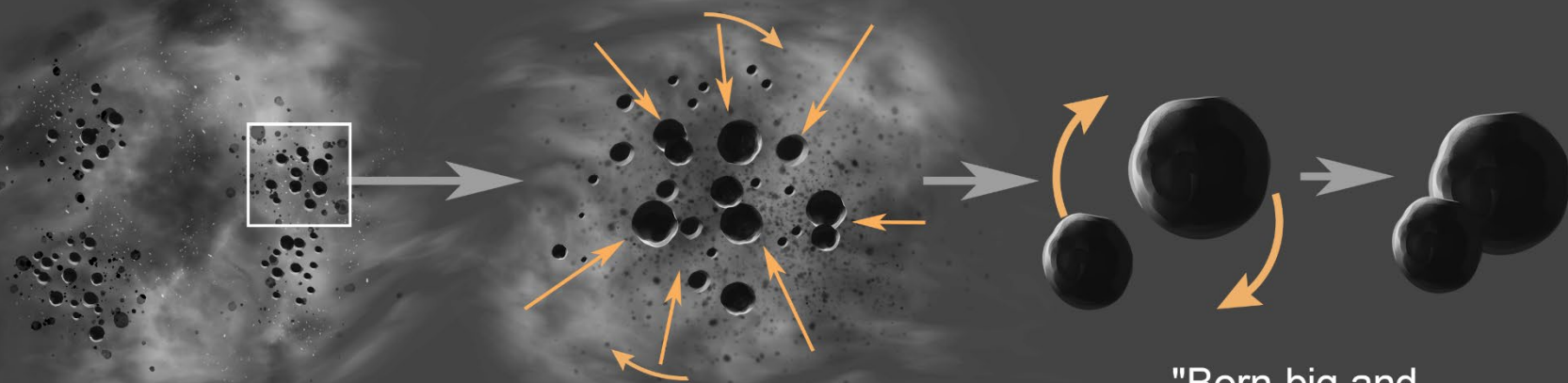
Protosolar disk

or

High-velocity, hierarchical accretion (100s of m/s or more)



Low-velocity, gravity-driven, local particle cloud collapse (a few m/s or less)



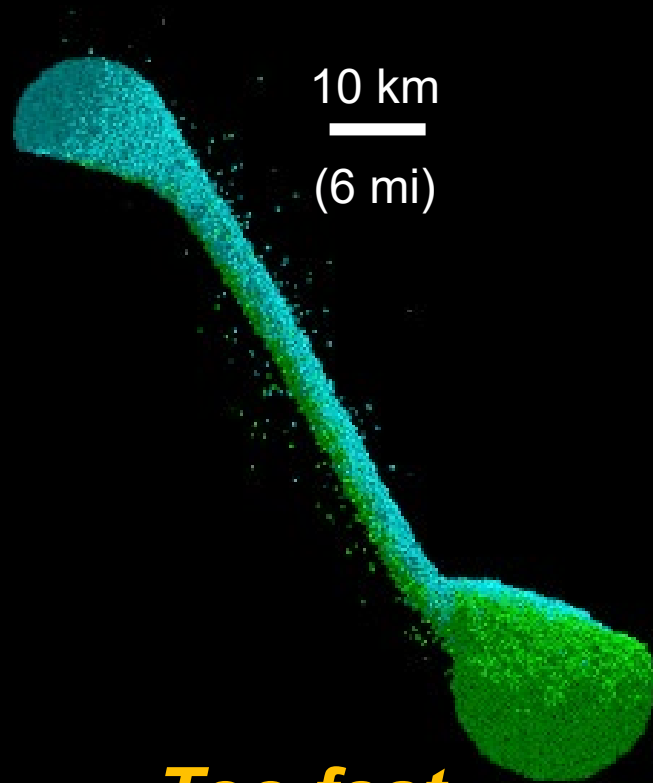
"Born big and often born binary"



Arrokoth:

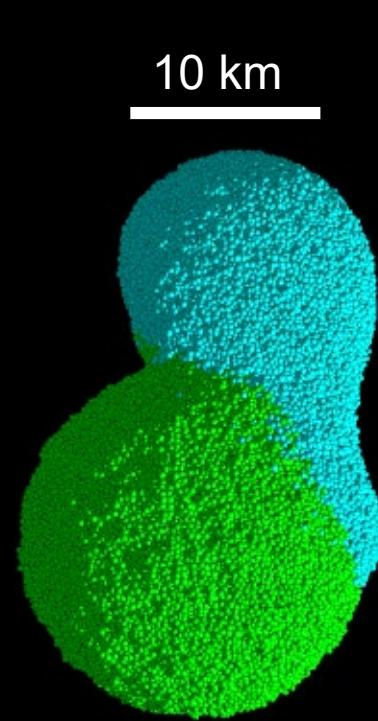
A gently assembled
binary planetesimal

Assembly Outcomes Depend on Speed



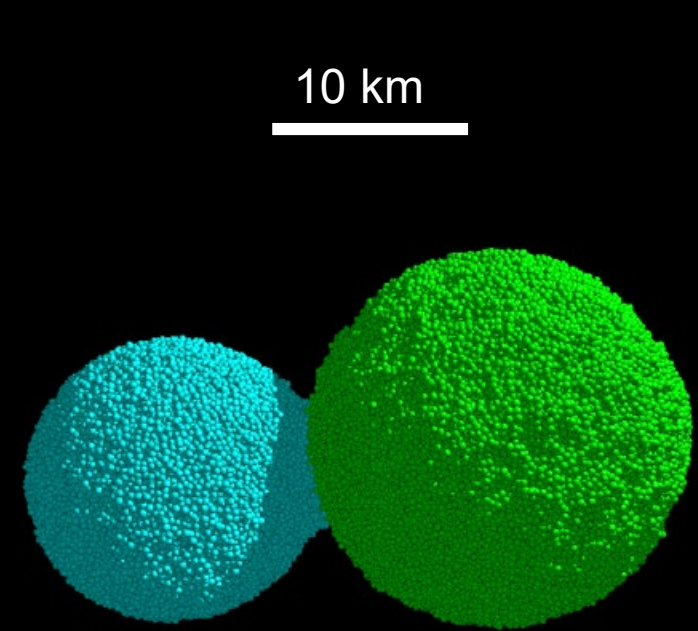
Too fast

10 m/s
(22 mph)



Borderline

5 m/s
(11 mph)



Just right

3 m/s
(7 mph)

Arbitrary colors

Conclusion



High-velocity, hierarchical accretion: ruled out by Arrokoth 🙅

Low-velocity, gravity-driven, local particle cloud collapse: formed Arrokoth 👍

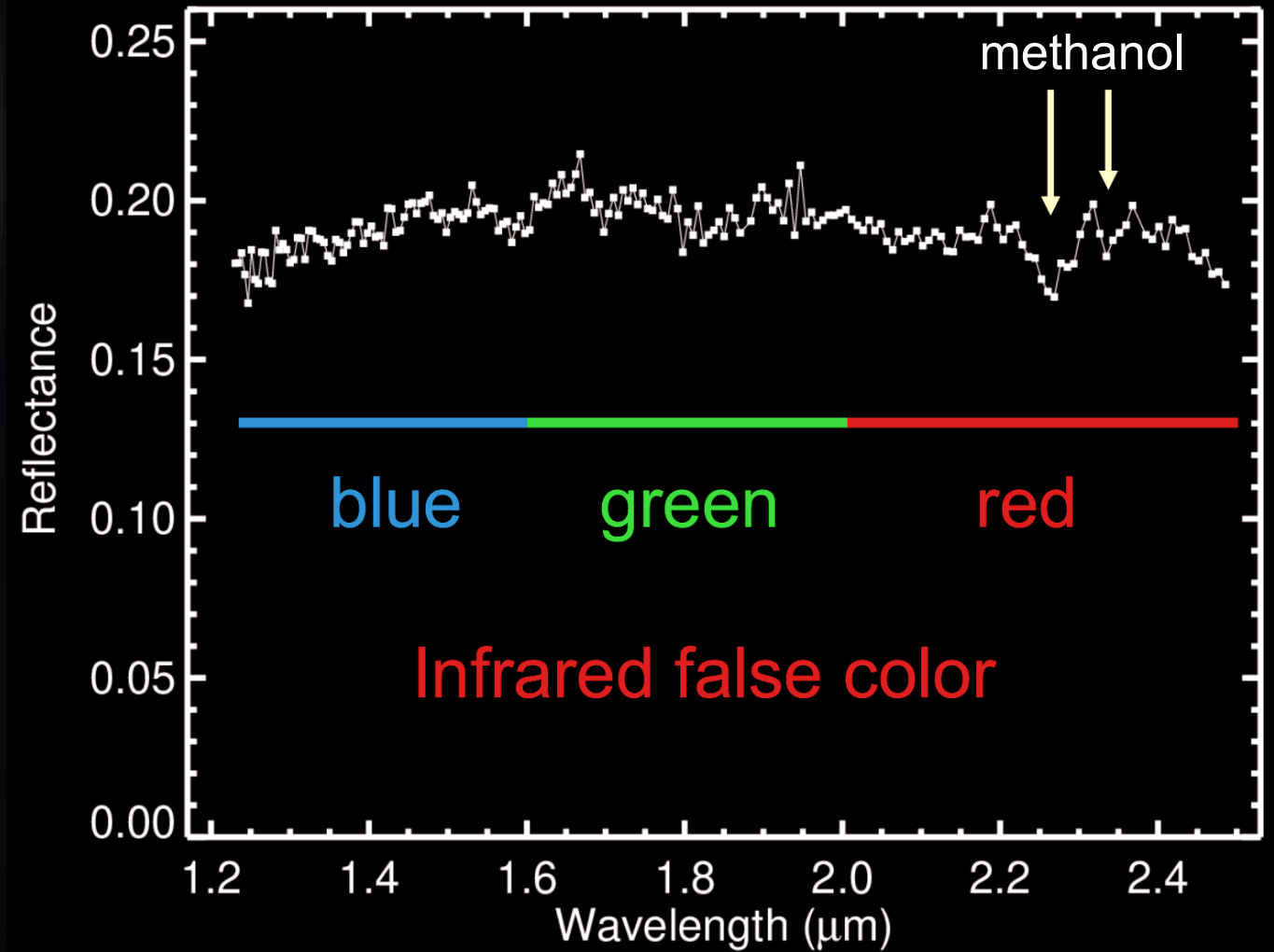
Color and Composition Evidence

Dr. Will Grundy
New Horizons Co-Investigator
Lowell Observatory

Uniform Visible Color



Uniform Near-Infrared



Shape Evidence

Dr. John Spencer
New Horizons Deputy Project Scientist
Southwest Research Institute

Flattened Shape





New Horizons in the Kuiper Belt:

Discovering How Planetary Building Blocks Form

Arrokoth	Cloud Collapse
Gentle Merger	✓
Smooth Lobes	✓
Uniform Color	✓
Uniform Composition	✓
Flattened Lobes	✓
Lobe Alignment	✓





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