KUIPER: A DISCOVERY-CLASS OBSERVATORY FOR OUTER SOLAR SYSTEM GIANT PLANETS, SATELLITES, AND SMALL BODIES. J.F. Bell III[1], N.M. Scheider[2], M.E. Brown[3], J.T. Clarke[4], B.T. Greenhagen[5], A.R. Hendrix[6], M.H. Wong[7] and the Kuiper Team, [1]School of Earth & Space Exploration, Arizona State Univ., Tempe AZ (Jim.Bell@asu.edu); [2]Univ. Colorado/LASP; [3]Caltech; [4]Boston Univ.; [5]JPL/Caltech; [6]PSI; [7]UC Berkeley.

Introduction: Kuiper is a Discovery mission concept dedicated to groundbreaking outer solar system science and exploration, with a significant component dedicated to the spectroscopic characterization of Kuiper Belt Objects (KBOs), Centaurs, Trojans, and irregular satellites. Through comprehensive time-domain and statistical population studies of the giant planets, their active satellites, and these important outer solar system small body populations, we will answer key Decadal Survey questions and provide the data sets and results needed to plan the next round of outer solar system New Frontiers and Flagship missions.

Mission Overview: The recent Planetary Decadal process has identified the most important science goals for the study of the outer solar system. However, after the end of the Cassini and Juno missions in 2017, outer solar system science could face over a decade (at least) without new U.S. missions. The Survey thus noted the critical role that space-based telescopic observations, especially those enabling significant time-domain and target coverage, can play in advancing key planetary science questions. We are thus proposing a dedicated planetary space telescope, implementable in the Discovery program, to conduct three diverse Decadal-scale science investigations.

Named after pioneering planetary astronomer Gerard P. Kuiper, the mission will address 9 of the Decadal's 10 Key Questions by studying 1) the giant planets, 2) their major satellites, and 3) key dynamical classes of small bodies that populate the outer solar system. Kuiper's three diverse investigations will enable significant advances in outer solar system science, through time-domain observations and substantial time on the targets. Advances in understanding the connections between weather and climate in giant planet atmospheres, as well as the interactions between giant planet atmospheres, satellites, and their external environments (*e.g.*, auroral, solar wind, plumes, impacts), require consistent, well-calibrated, nearly-continuous observations spanning timescales from hours to years.

Small Bodies Focus: Progress in understanding the ways that small outer solar system bodies can be used to understand the details of early giant planet migration requires compositional knowledge of statistically significant members of key dynamical populations. Observations with the required temporal coverage and fidelity needed to address these and many other important outer solar system Decadal science goals simply cannot be obtained from ground-based telescopes, or existing or planned space telescopes.

Specifically for outer solar system small bodies, Kuiper will conduct a rigorous spectral survey from 400 to 1600 nm of thousands of known outer solar system small bodies from key dynamical populations, including cold classical KBOs; red, hot classical KBOs; very red, hot classical KBOs; less red Jupiter Trojans; red Trojans; Centaurs; and the irregular satellites of the giant planets. Included among this population will be a significant sampling of very small objects (< 50 km diameter), including many down to magnitude V ~ 25.

Science Goals: Kuiper's outer solar system small bodies goal has three primary science objectives:

Smooth Migration vs. Catastrophic Scattering: Did the giant planets migrate smoothly to their present positions or were they catastrophically moved by dynamical instability? Kuiper will trace differences between smooth migration and dynamical instability by mapping (through VIS-NIR spectroscopic parameters) the scattering of the cold classical Kuiper Belt into the resonant & non-resonant populations of the Kuiper belt.

The Kuiper belt-Jupiter Trojan connection: Are the KBOs & Jupiter Trojans derived from the same source populations, as required by a dynamical instability or are they distinct as predicted in slow migration? The Jupiter Trojans and KBOs are currently spectrally distinct. Do the intermediate populations trace a surface evolution allowing us to connect these populations?

Pair-wise accretion vs. gravitational collapse: Did the planetesimal making the small bodies of the outer solar system for from slow pairwise accretion or through fast gravitational collapse? Slow planetesimal accretion builds populations that are then collisionally ground down. Freshly-exposed water ice, a signature of such collisions, should be visible in the fresh surfaces of the smallest bodies

Kuiper's combination of spatial resolution, spectral resolution, far-UV to near-IR coverage, and substantial time-domain sampling will offer an efficient, affordable, and highly relevant facility guaranteed to yield diverse, new insights and to inform planning of *in situ* missions for future decades.