## The New Horizons search for distant KBOs

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### Project Goals

 Use ground-based deep observations to discover new Kuiper Belt Objects bright enough for observation with the LORRI telescope (r<sub>Earth</sub>~26, V<sub>LORRI</sub>~21).

 To characterize the phase curves and high-phase light curves of discovered targets

To search for any potential new flyby targets

# **KBO Phase Curves - Surface properties**

### New Horizons and SUBARU HSC Searches

A group of Japanese solar system astronomers has joined the New Horizons science team. Working together we are searching for new distant KBOs that can be observed from New Horizons. First search was in 2020 with followup searching in 2021 (analysis on-going) and a plan to being a VERY deep search starting in 2023.

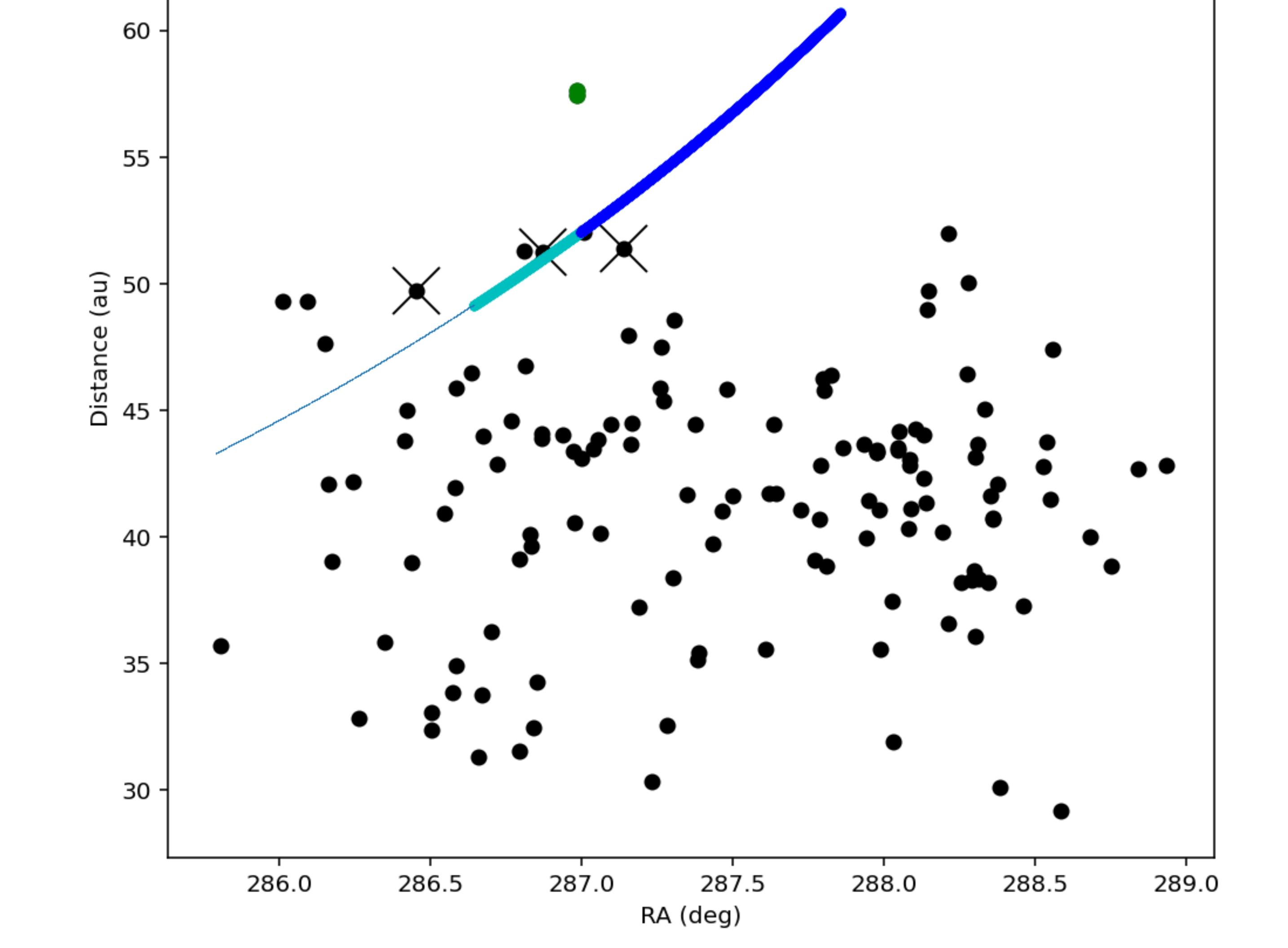
NH Trajectory

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From New Horizons we can observe these distant solar system bodies over a wide range of phase angles that are impossible to access with Earth localized observing. The observations probe the reflectance properties of the surface material and provide clues to the structure of the surface (fine grain material versus rough surfaces)

Current observations indicate that the larger KBOs (bottom) panel) have shallow phase curves compared to the Cold Classical Kuiper belt objects (top panel) observed during the first Kuiper Extended Mission.

The Cold Classical, however, may have surge affects that are small than their 'Hot' counter parts (middle panel) but with steeper phase curves at large angle. This appears to be revealing a change in surface properties between these classes of objects. These surface composition difference may be related to the location of formation of these objets.



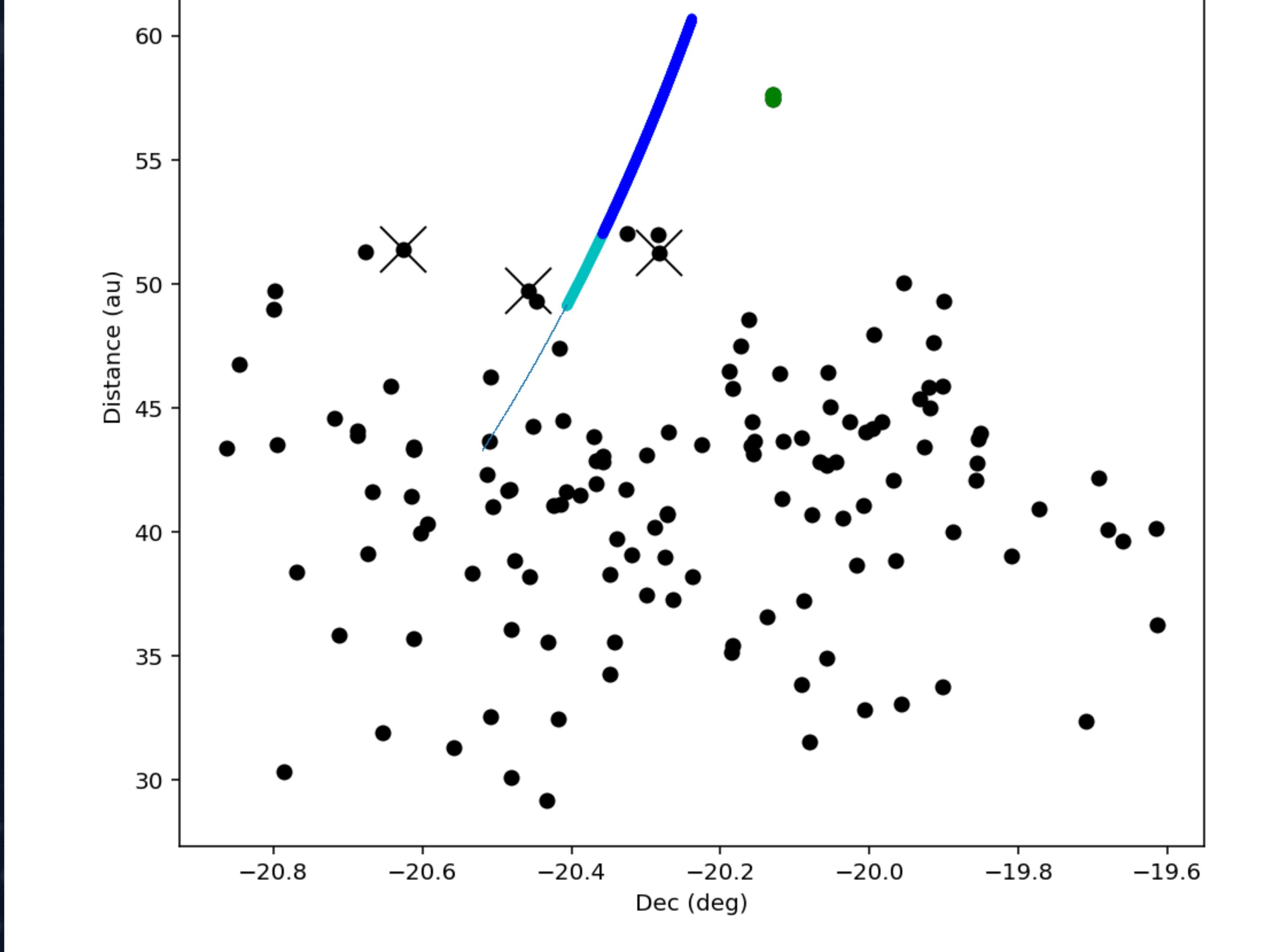
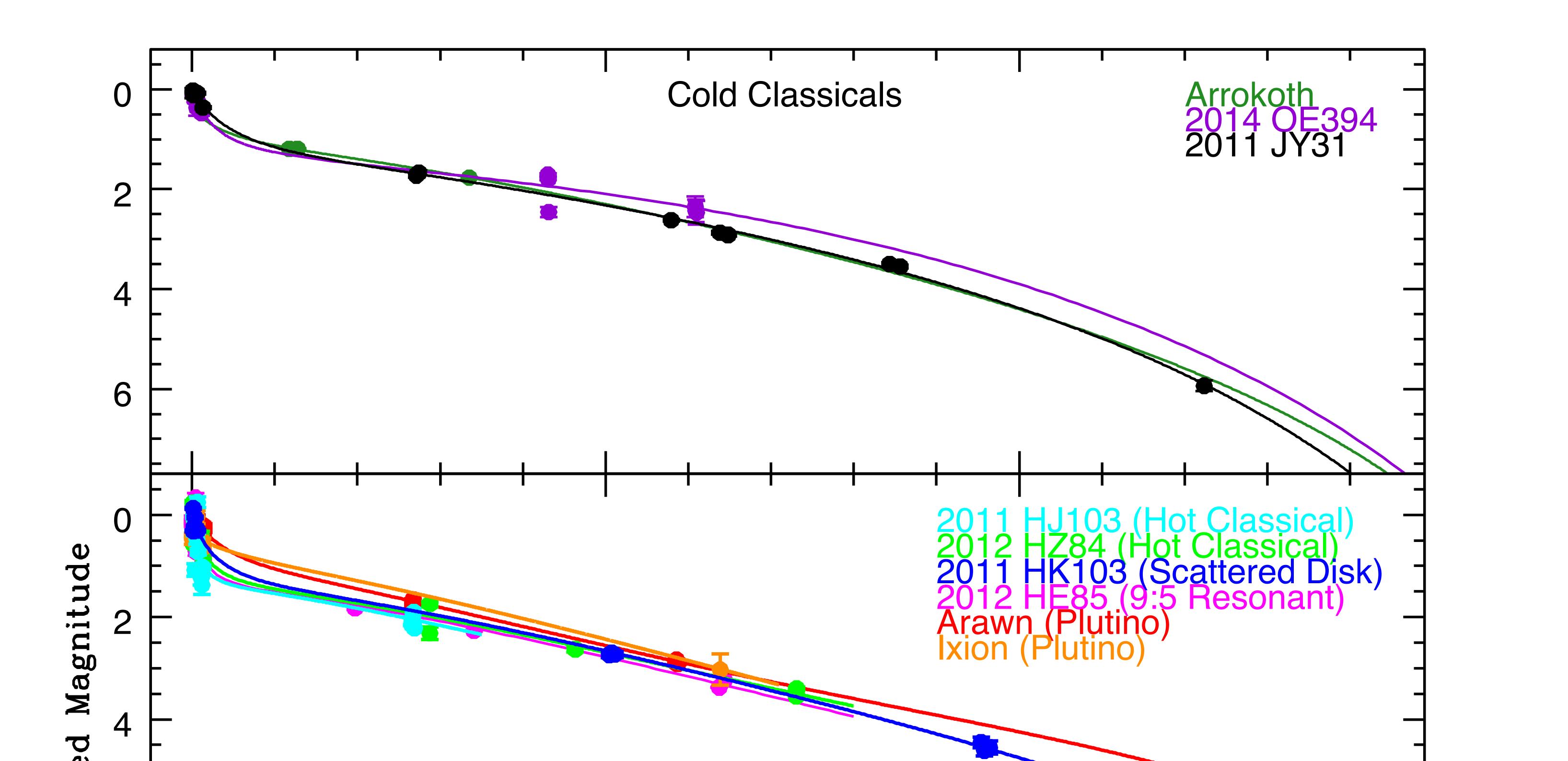


Figure presents the RA/DEC/Distance of the 135 KBOs detected in our 2020 search that now have secure orbits. Objects with 'X' have been observed by New Horizons LORRI in 2021. Line indicates the trajectory of

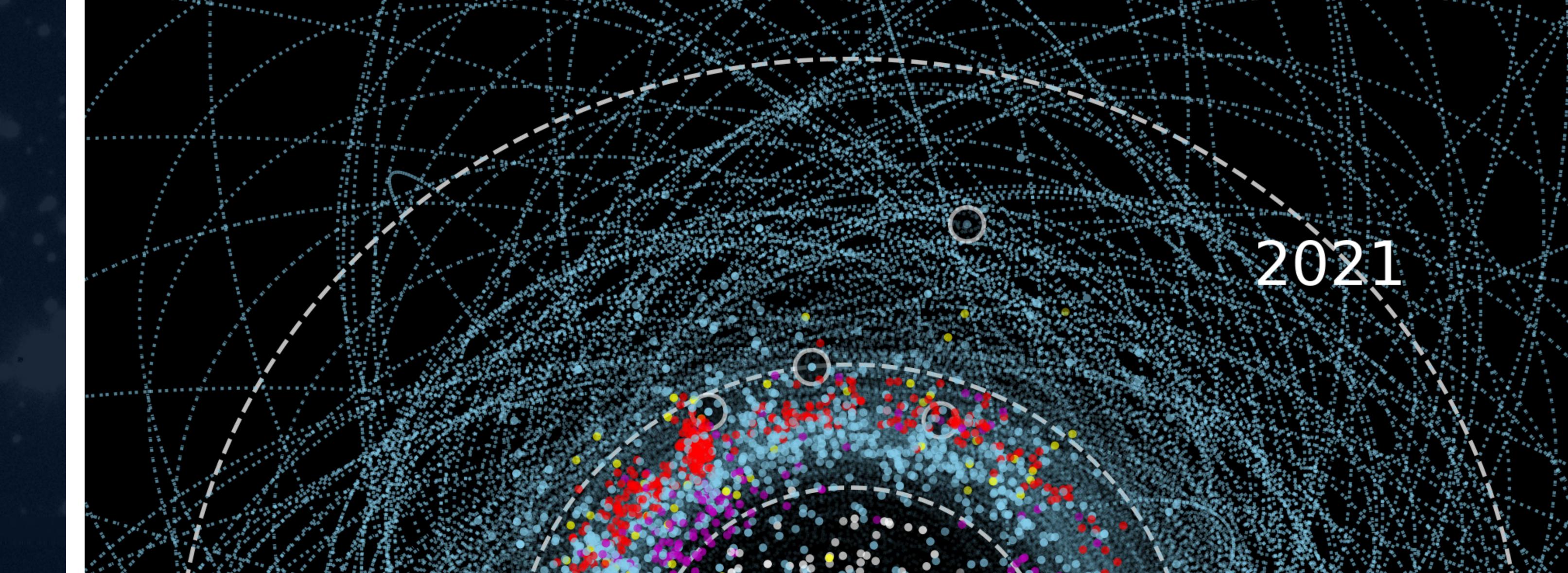
Our plan is to continue to explore the properties of the Hot objects to better compare their phase behaviour to that of the Cold population.

New Horizons wth CYAN line indicating the path in 2021 and the blue line indicating the path for 2022 and beyond.

In 2022 we will continue our search, shifting our search fields centres and making use of a new 'wide' filter that New Horizons has commissioned for Subaru HSC.



The Kuiper Belt



## New Subaru HSC w Filter

Solar System objects have flat-red spectra. By creating a 'wide' filter that includes most of the optical spectrum we can search 0.5 mags deeper than perviously possible with the r2 filter. We hope this new filter will be available for general use by Subaru by the start of 2023A

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