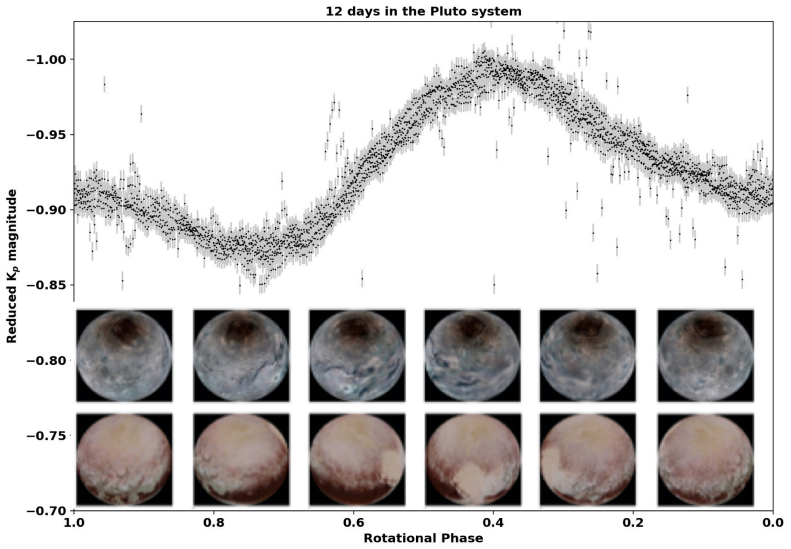
K2 Mission Observations of 12 Days in the Pluto-Charon System

What is the science question? Does molecular nitrogen (N_2) and methane (CH_4) frost move over the surface of Pluto with the seasons?

What were your findings? During its K2 extended mission, the Kepler spacecraft's imaging photometer monitored the Pluto-Charon system for an unprecedented and nearly continuous 83 days (>12 Plutonian days) in late 2015 after the New Horizons flyby. K2's combined Pluto+Charon lightcurves* measured at this epoch have an average total amplitude that is significantly smaller than predicted by a static frost model.

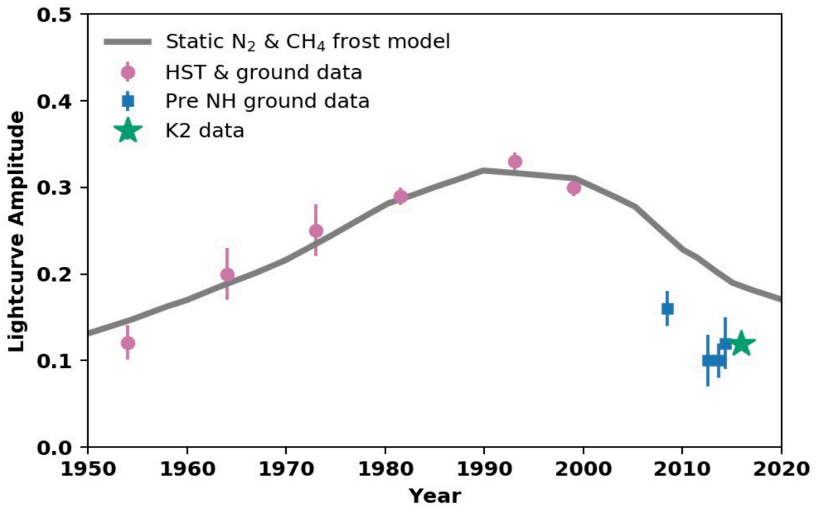
What is the impact? Prior Hubble Space Telescope observations of Pluto in the 1990's observed lightcurve variations, but these were attributed to differences in viewing geometry and a static surface frost of N_2 and CH_4 was assumed. These K2 data demonstrate that the changes in Pluto's lightcurve with time exceed the changes expected from observational geometry alone and suggest that the N_2 and CH_4 materials are transported over the surface with the seasons.

Why does it matter to non-scientists? While its original purpose was to discover hundreds of extra-solar planets, Kepler in its K2 extended mission is now being used to better understand seasonal processes on planets in our own solar system.



Above: This composite lightcurve from K2 is a function of the light reflected by both Pluto and Charon.

Below: Multi-year amplitudes of Pluto's reflected light show that the K2 data are not consistent with the static frost model (grey line).



*A lightcurve is a plot of the change in brightness over time

Benecchi, S.D. *et al.*, 2018. Icarus 314, 265–273.