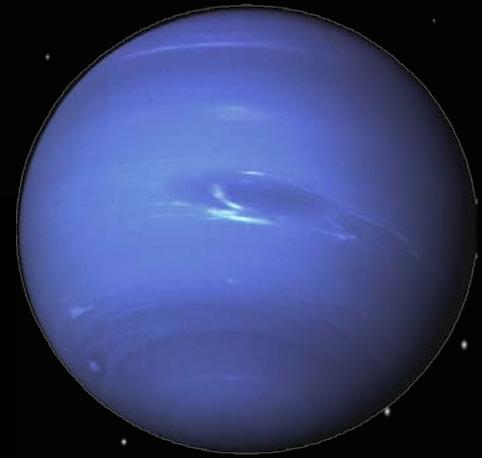
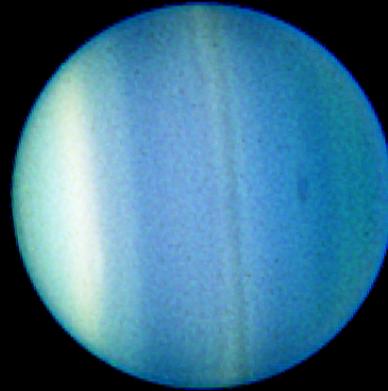
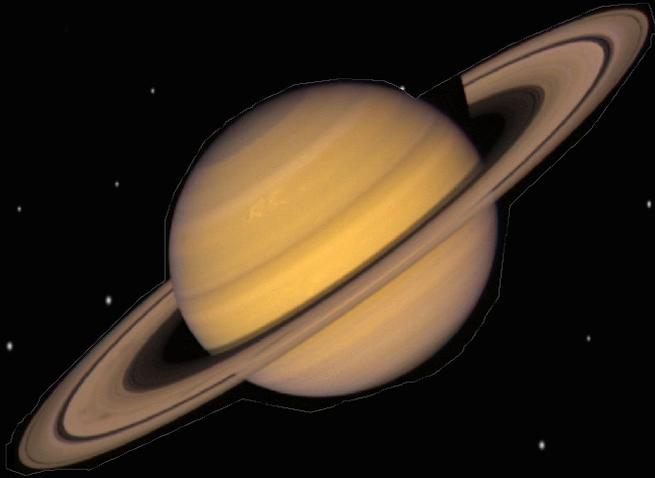


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August 2015

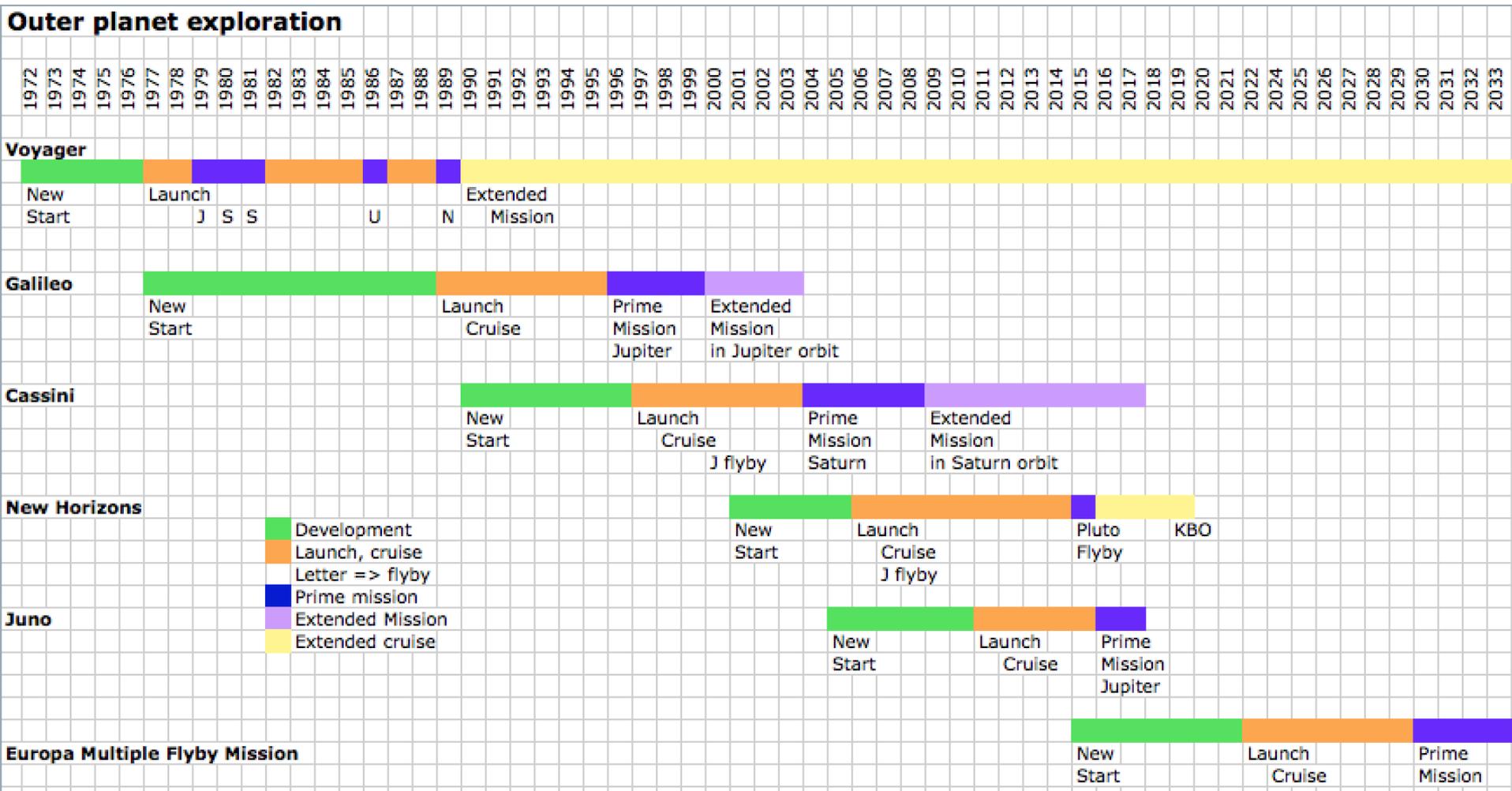


# Major objectives for this meeting

- Celebrate the present – it's a great time to be an outer solar system scientist
  - Pluto!!
  - Cassini and Juno less than a year away from intense orbital operations
  - Europa Mission new start
- What we need to explore the outer solar system
  - Power for spacecraft
  - Technology development
- Defining our science goals
  - Progress on the new science goals document
  - New ideas for the over-arching science theme
  - Preparing for the next decadal survey
- Challenge: How to keep outer solar system science vibrant through the decade gap to the Europa multi-flyby mission operations
  - The importance of R&A -> Science nuggets
  - Telescopic opportunities

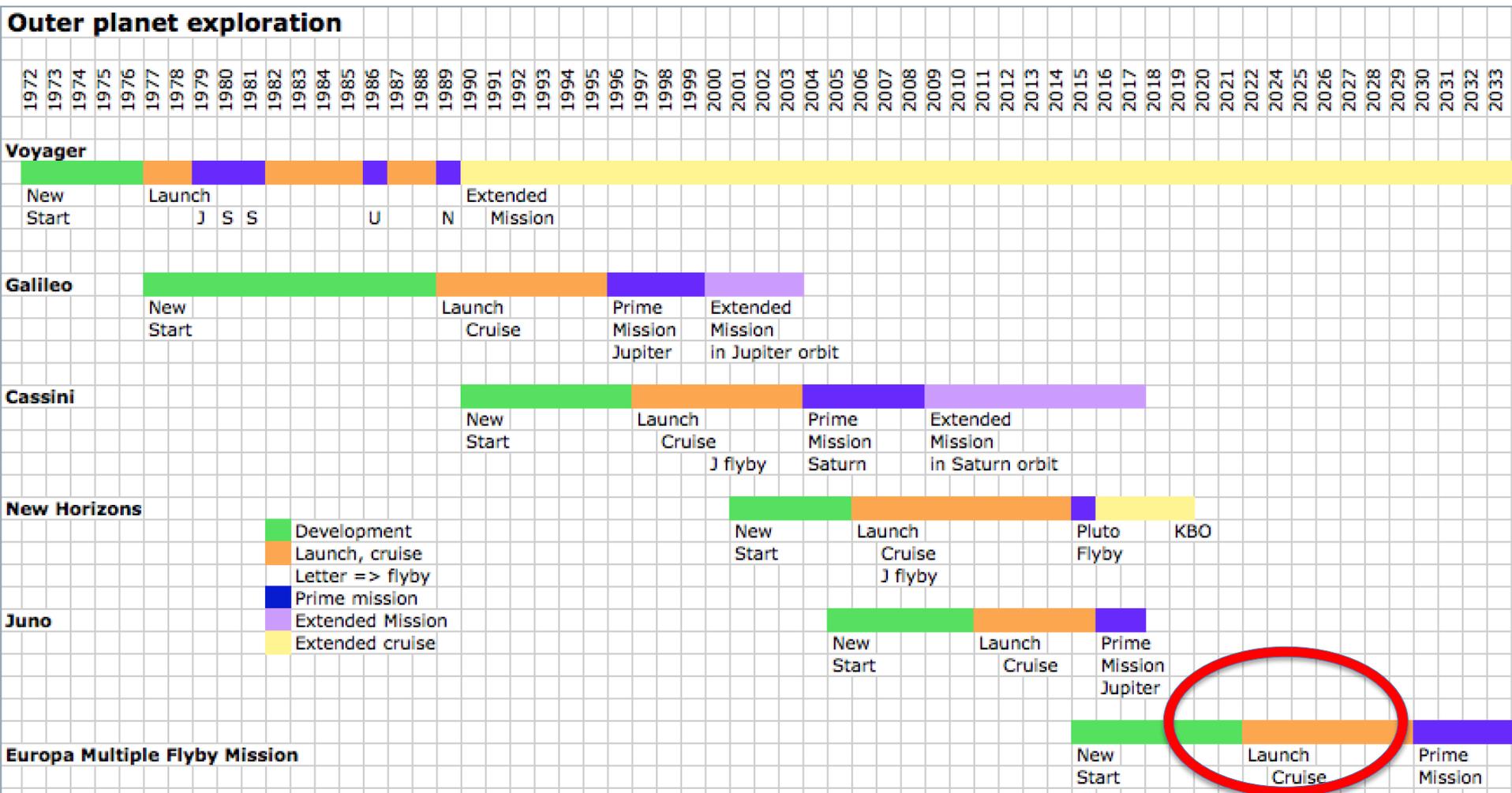


# Now: Outer solar system exploration has a future!



- With the new start of the Europa Multiple Flyby Mission the gap has an end

# Now: The New Challenges



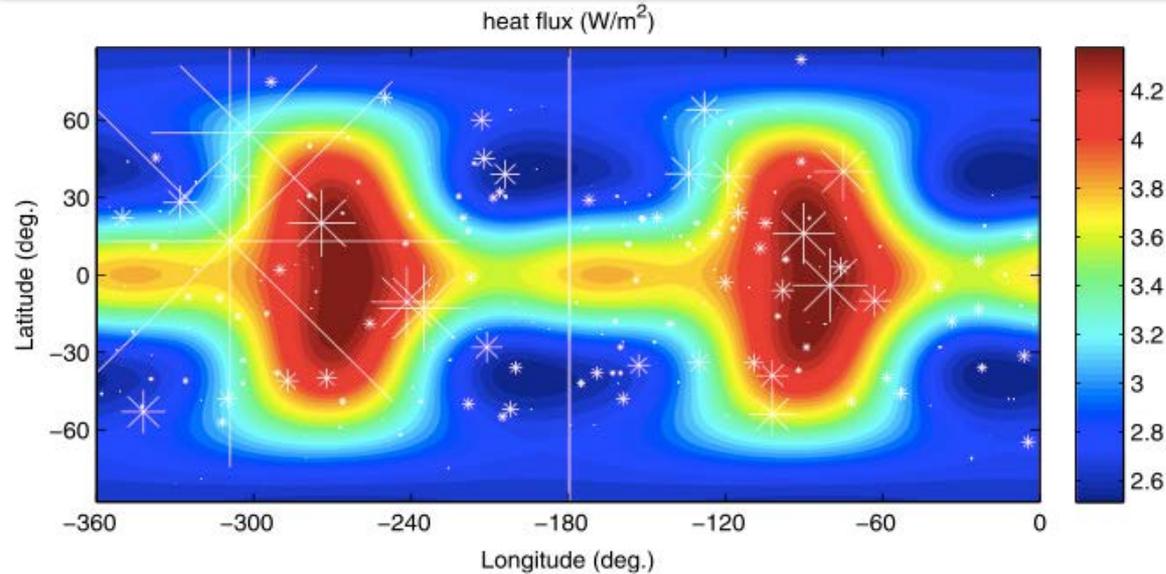
- How to keep the community vibrant until ~2030
- What comes next?

# Science Nuggets

- What is a nugget?
  - A one-page chart highlighting a new result
  - (Every paper should be accompanied by a nugget)
- What makes a good nugget? Why are nuggets important? Where do nuggets go? *Jim Green*
- How do I construct a nugget? *Scott Edgington*
- R&A nugget construction – *all*
- Show your nugget (Wednesday)

# Tidal Heating in Io's Magma Ocean

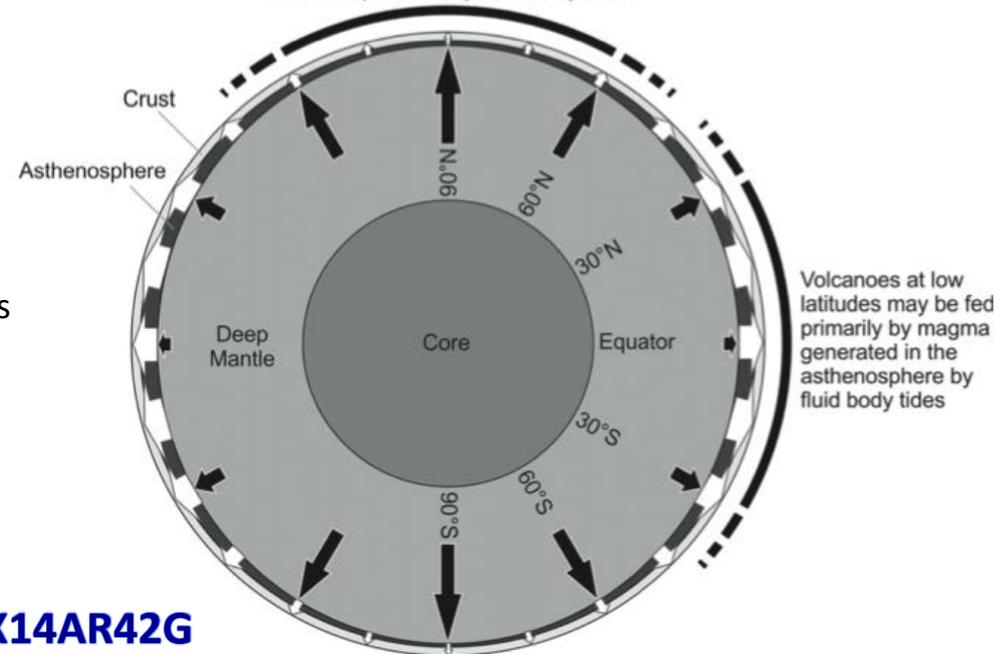
Tyler, Henning, and Hamilton (2015) *The Astrophysical Journal*, 218:22



**Left:** Map of the tidal surface heat flux for a combined case that includes both fluid and solid tidal heating. The combined model achieves the goal of supplying tidal heat to both the poles and equator, with equatorial maxima shifted  $\sim 30^\circ$  in longitude from the subjovian point, matching the observations. Stars show the locations of dark floored paterae from Veeder et al. (2012), with symbol sizes scaled to their power output.

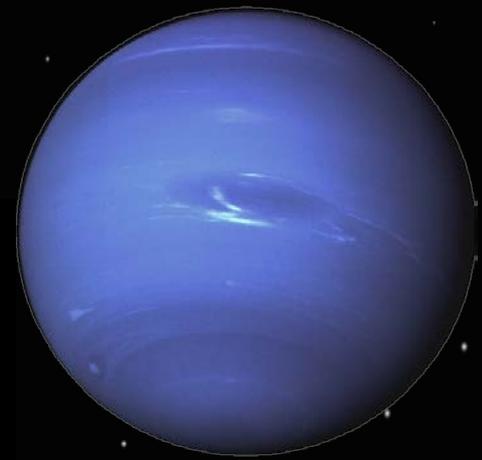
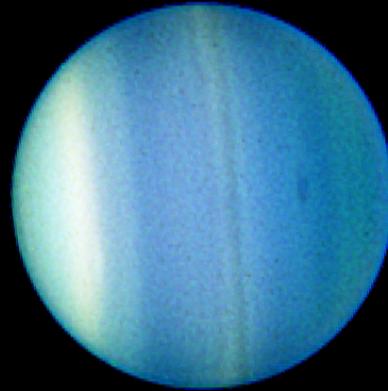
Volcanoes at high latitudes may be fed primarily by magma generated in the deep mantle by solid body tides

**Right:** Sketch of a model for Io with simultaneous fluid and solid tidal heating occurring in separate layers. Fluid tidal heating originates from a thin magma ocean, asthenosphere, or magma-slush partial melt layer, and provides tidal heat flux primarily into equatorial volcanoes in a pattern that is not symmetric about the sub-Jovian point, but instead offset in longitude by  $\sim 30^\circ$ . Simultaneous solid-body tidal heating occurs below this high melt fraction top layer, and produces a significant polar contribution of tidal heat flux. Black and white arrows represent heating from the deep mantle and asthenosphere, respectively, and are scaled to schematically represent latitudinal variations in heat flux.



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# Outer Solar System Exploration



*Worth the journey*