

# The Kuiper Belt at 20

September 3 2012



Some planets of the Kuiper Belt; note that since this diagram was made, we've learned that Eris is actually smaller than Pluto. Credit: [sollunaterra.webs.com](http://sollunaterra.webs.com)

Planetary science is celebrating the 20th anniversary of the discovery of the Kuiper Belt. That came in 1992, when the first Kuiper Belt Object (KBO) was discovered.

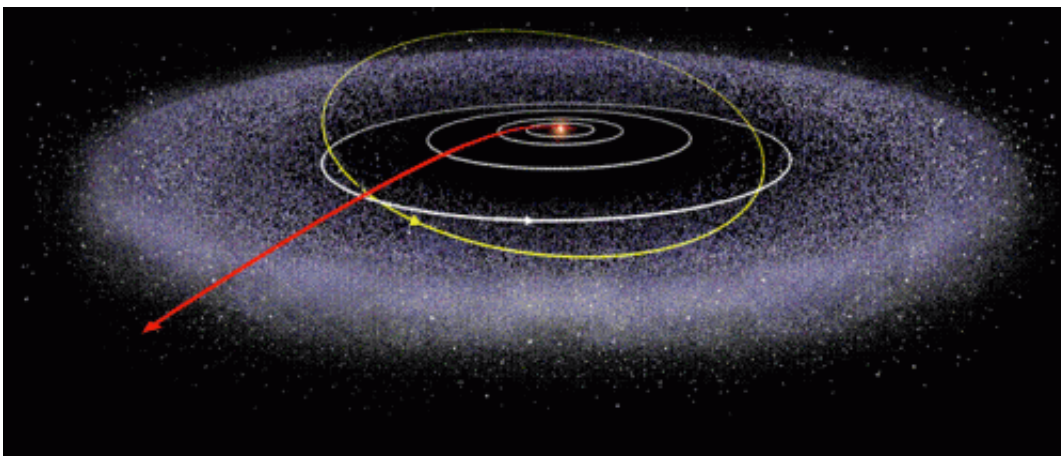
Actually, of course, the first object in the Kuiper Belt was discovered in 1930—Pluto itself; and the second such object, Pluto's giant moon Charon, was discovered in 1978. The Kuiper Belt was first postulated—most famously by Gerard Kuiper—by planetary scientists back in the 1930s, '40s and '50s. But it took until 1992 for technology to mature sufficiently enough to find another object (outside the Pluto system) orbiting the Sun beyond Neptune.

Since 1992, more than 1,000 KBOs have been discovered. But only a tiny fraction of the sky has been surveyed for KBOs. It is estimated that more than 100,000 KBOs exist with diameters of 100 kilometers or

larger, along with billions of smaller objects down to the size of cometary nuclei, just a kilometer or two across. (By comparison, Pluto is huge—its diameter is almost 2,400 kilometers, making a drive around its [equator](#) as far as from Manhattan to Moscow!)

Most of the known KBOs are just 100 to 300 kilometers across, about one-tenth of Pluto's diameter. But some are smaller than 100 kilometers across, and some are larger than 300 kilometers across. In fact, there is great diversity among KBOs:

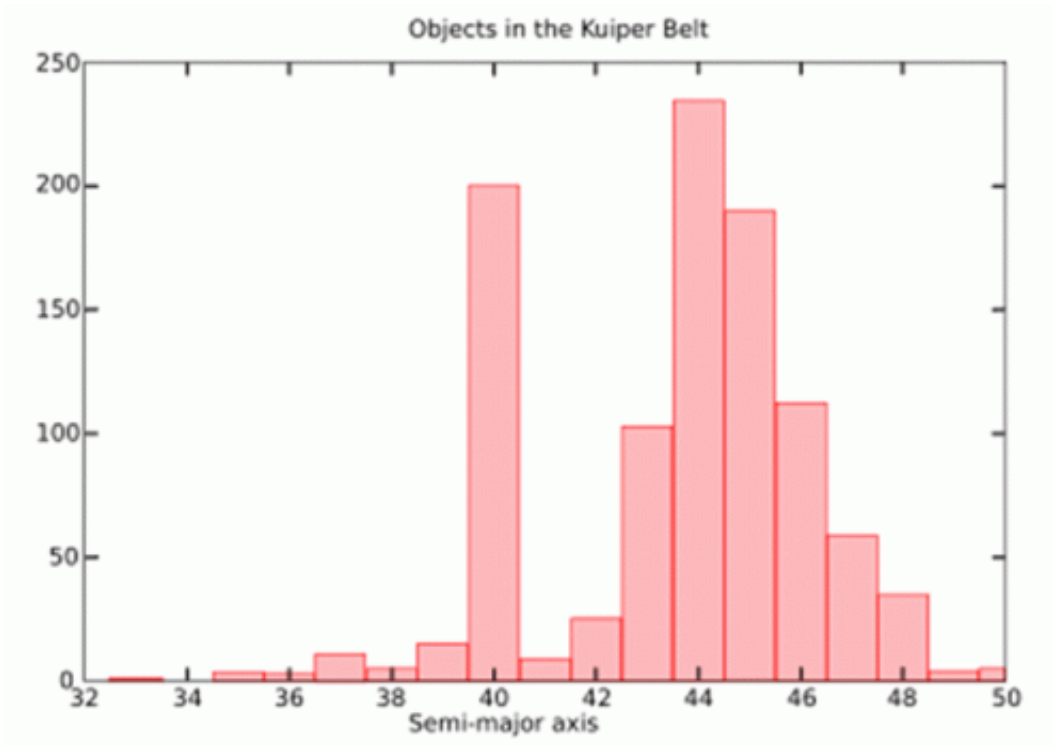
- Some are red and some are gray;
- The surfaces of some are covered in [water ice](#), but others (like Pluto) have exotic volatile ices like [methane](#) and nitrogen;
- Many have moons, though none with more known moons than Pluto;
- Some are highly reflective (like Pluto), others have much darker surfaces;
- Some have much lower densities than Pluto, meaning they are primarily made of ice. Pluto's density is so high that we know its interior is about 70% rock in its interior; a few known KBOs are more dense than Pluto, and even rockier!



New Horizons hopes to explore beyond Pluto, into the ancient and unexplored Kuiper Belt. Credit: NASA

But I don't consider this surprising assortment of KBOs to be the most important contribution to our knowledge of the [Solar System](#) that has come from telescope exploration of the Kuiper Belt. In my opinion, the three greatest solar system lessons we've learned from the Kuiper Belt are:

- That our planetary system is much larger than we used to think. In fact, we were largely unaware of the Kuiper Belt—the largest structure in our solar system—until it was discovered 20 years ago. It's akin to not having maps of the Earth that included the Pacific Ocean as recently as 1992!
- That the locations and orbital eccentricities and inclinations of the planets in our solar system (and other solar systems as well) can change with time. This even creates whole flocks of migration of planets in some cases. We have firm evidence that many KBOs (including some large ones like Pluto), were born much closer to the Sun, in the region where the giant planets now orbit.
- And, perhaps most surprisingly, that our solar system, and very likely very many others, was very good at making small planets, which dominate the planetary population! Today we know of more than a dozen dwarf planets in the Solar System, and those dwarfs already outnumber the number of gas giants and terrestrial planets combined. But it is estimated that the ultimate number of dwarf planets we will discover in the Kuiper Belt and beyond may well exceed 10,000. Who knew? (And which class of planet is the misfit now?)



This plot shows one aspect of Kuiper Belt structure: Different numbers of bodies orbit at different distances. This graph includes just the known bodies, which make up a tiny fraction of the grand total. Credit: Wikipedia

What an amazing set of paradigm shifts in our knowledge the Kuiper Belt has brought so far. Our quaint 1990s and earlier view of the Solar System missed its largest structure! It didn't know about the existence of dwarf planets, the most populous class of planet in our solar system—and very likely the galaxy. It didn't even contemplate that dwarf planets would have such a wide range of colors, reflectivities, orbits and surface compositions. And it didn't realize that the locations of most planets in our solar system today—even including some of the very largest planets—are different from where they were born.

Just imagine—when the New Horizons spacecraft has its close flybys of the Pluto system and smaller KBOs, combined with new giant telescopes coming on line to probe the sky—what we will learn about the Kuiper

Belt in the next 20 years. It's an exciting time, and it's sometimes hard for me to believe after working on this since 1989, that our 2015 exploration of Pluto and its many moons is almost upon us—but it is!

New information about the Solar System is important to astrobiologists who are trying to determine how our system evolved to support the only habitable planet yet known - Earth. This knowledge is useful in determining where else in the Universe habitable planets might exist.

Source: Astrobio.net

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