The Oort Cloud – Solar System or Beyond?

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1. Background

The current size and boundary(s) of the Solar System cannot be easily determined. There are several regions that have been put forward as an appropriate boundary – the Termination Shock point within the Heliosphere where the pressure of the ISM (Interstellar Medium) results in a slowing of the Solar Wind, the Heliopause (contained within the Heliosheath) or the Bow Shock (phenomena caused by the Heliosphere interacting with the ISM). The ISM is defined as the region(s) of space over which no single star has dominance), ergo beyond the Solar System.

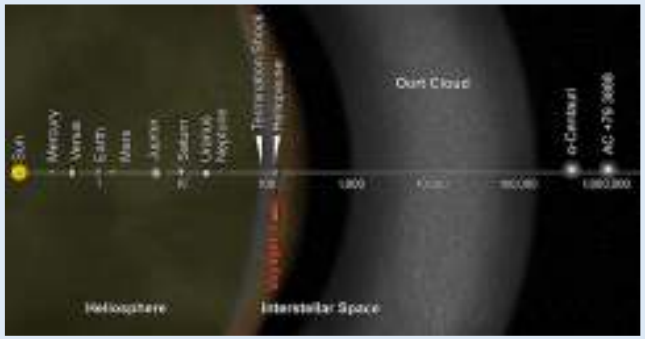

Figure 1. Graphic showing distances from the Sun in AU for major Solar System bodies/boundaries out to the Oort Cloud and beyond to the nearest extrasolar Star, α-Centauri at 1,000,000 AU. The graphic also shows the Voyager 1 spacecraft crossing into the Interstellar Medium at ~100 AU, some 900 AU before expected first encounter with the Oort Cloud at 1,000 AU. Estimated timeframe for Voyager 1 to reach and cross the Oort Cloud is around 300 years and ~30,000 years respectively (NASA).

The physical characteristic that currently defines the boundary of the Solar System is generally considered to be the effective influence of the Solar Wind – a high speed flow of particles, mainly protons and electrons. The Solar Wind emanates from the Sun, continuing through the Heliopause to the Bow Shock, at which point it can be turned back on itself (Green & Jones, 2015). This, therefore, has proved a convenient region to designate as the boundary of our Solar System and the start of interstellar space.

At vast distances, beyond the obvious dominant effects of the Solar Wind can be found the region of space termed the Oort Cloud. As currently theorised (the existence of the Oort Cloud has not been confirmed through observation and remains theoretical, put forward by Dutch Astronomer Jan Oort whom predicted its existence in 1950) is a region of icy bodies (Comets) shrouded around the Solar System like a vast sphere. These icy bodies move with the Sun within the Milky Way galaxy (Hanse *et al*, 2017 & Green & Jones, 2015).

2. The Solar Wind & the Oort Cloud

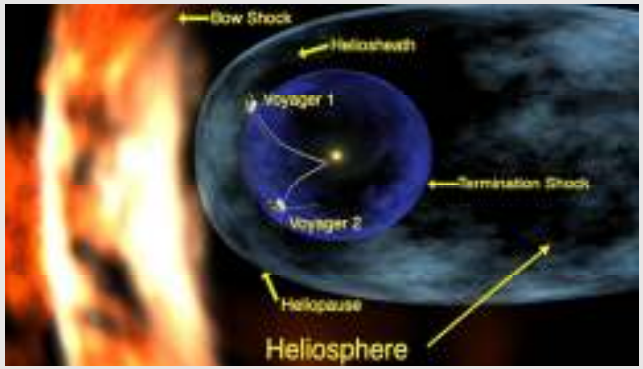

Figure 2. Graphic showing several contentious points for the boundary of the Solar System with the Sun at its centre. The Termination Shock (with tracks of the two Voyager spacecraft), Heliopause (the boundary of the Heliosheath) and the Bow Shock. NASA

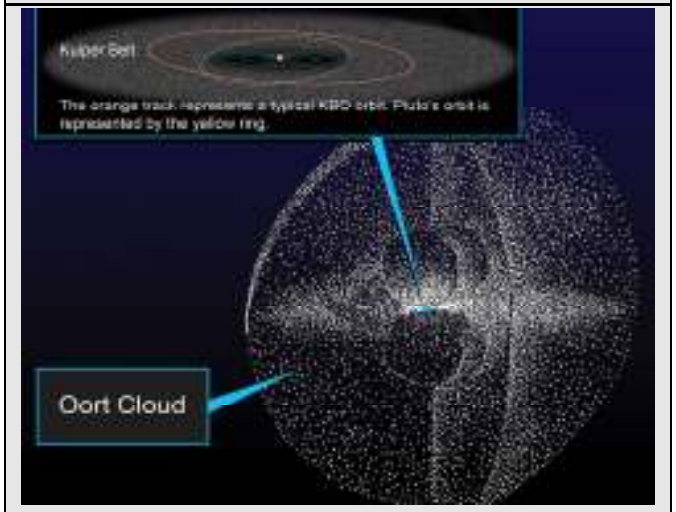

Figure 3. Graphic depicting the theorised Oort Cloud – hundreds of billions of icy bodies shrouded around what we define as the Solar System. Whilst the Oort Cloud would be located at vast distances beyond what is currently accepted as the boundary of the Solar System, the objects within predominantly come under the gravitational influence of The Sun, which they orbit. Oort Cloud bodies take thousands to hundreds of thousands of years to complete a single solar revolution. NASA

3. Summary/Discussion & References

The scientific evidence suggests that the effects of the Suns gravitational pull has considerable influence on celestial bodies out to the Oort Cloud. This is considerably beyond (perhaps around 900 AU – 100,000 AU) the obvious effects of the Solar Wind. The gravitational influence is so great that Oort Cloud bodies are pulled into orbit around the Sun, which affects those bodies considerably more than gravitational perturbations caused by nearby extrasolar Stars.

It is recommended that the accepted boundary of our Solar System be reconsidered as the evidence supports the case for that boundary extending out to the outer Oort Cloud, currently defined as being in the realm of the Inter Stellar Medium. Additional research is required into the effects and reach of the Solar Wind, the Suns gravitational effects on Oort Cloud bodies and on efforts to observe the Oort Cloud, directly or indirectly, in order to confirm or refute its existence.

Figure 4. Graphic depiction of the Voyager 1 spacecraft, the most distant human made object, entering what is defined as Interstellar Space at around 100 AU, in 2012. NASA

Regardless of whether or not it is defined as being in Interstellar Space or an integral region of our Solar System, the Voyager 1 spacecraft will not reach the Oort Cloud for around 300 years, emerging from the other side ~30,000 years distant.

Select references

Green, Simon F. & Jones, Mark H. (2015) 'An Introduction to the Sun and Stars: Second Edition', Cambridge University Press/The Open University

Hanse, J., Jilkova, L., Portegies Zwart, S.F. & Pelupessy, F.I. (2017) 'Capture of exocomets and erosion of the Oort Cloud due to stellar encounters in the Galaxy', Monthly Notices of the Royal Astronomical Society

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