# Astronomers Hope to Shed Light on the Birth of our Solar System Through the Study of Thirty-Five Distant Objects known as TNOs

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Trans-Neptunian Objects, or TNOs, are distant objects in our Solar System that orbit our Sun at a distance greater than the orbital distance of Neptune. TNOs are leftovers from a ring of matter known to astronomers as the protoplanetary disk. All the planets in our Solar System formed from this disk shortly after the birth of the Sun approximately 4.6 billion years ago. Understanding the physical properties of TNOs is essential to understanding the formation and evolution of our Solar System. There exists around 2,300 known TNOs, but astronomers have only studied a few of them extensively.

Astronomers use a technique called photometry to determine the physical characteristics of TNOs. Photometry involves observing the brightness and color of the objects being observed. Apparent magnitude is a concept in astronomy that measures the brightness of the observed object as seen from Earth. Measuring the brightness of TNOs allows astronomers to calculate the absolute magnitudes of these objects where the intrinsic brightness is a measure of brightness at a standard distance from the object. Astronomers are interested in the intrinsic brightness of TNOs because they can use them to approximate the size of the TNOs.

When light travels from the Sun to objects in our Solar System, it is reflected off these objects as a spectrum of light rather than one specific color. The color of trans-Neptunian objects can be determined by using special light filters in conjunction with very powerful telescopes. These filters allow a particular color of light through to the telescope, and astronomers can then measure the brightness of the TNOs at that color. The color of the TNO can then be determined through the comparison of these magnitudes through different filters. Different colors of TNOs imply different physical compositions.

Trans-Neptunian objects show a diversity of colors, ranging from neutral browns and greys to reds. It had been suggested in earlier studies that colors of TNOs along with other physical properties, such as size, can be used to describe their surface properties and evolution. However, recent laboratory work has shown that organic compounds – chemical compounds containing Carbon – weather over time thereby varying the kinds of light we can see reflected off the surface of the TNO. Therefore, the physical properties of TNOs cannot be fully described by color alone. Thus, the diversity of colors of TNOs must be considered when attempting to determine their physical properties.

Astronomers have split the TNOs being observed into two subgroups – large and small. There seems to be a gap between the two groups, but this has yet to be confirmed. Astronomers also found that the larger TNOs tend to be less red than the smaller TNOs, and that the surface temperature of these TNOs doesn’t seem to be a factor when determining color. The larger TNOs tended to be brighter because of collisions with other objects in the Kuiper Belt – a large ring of TNOs in our solar system. These collisions resurface the large TNOs thereby making them more reflective and appear brighter when observed from Earth.

While this study wasn’t comprehensive enough to tell us everything about TNOs, it provides useful trends and data points that will aid future astronomers in learning more about these distant and mysterious objects.