Inner Oort Cloud survey and the discovery of 2012 VP_{113}

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Since 2012 we have been performing the largest and deepest survey for solar-system objects beyond the Kuiper-belt edge at 50 au. We are using the 2.7 square degree DECam on the CTIO 4-meter telescope in Chile. To date we have found several hundred transneptunian objects (TNOs), including the second known Sedna-like object 2012 VP_{113}. 2012 VP_{113} has the most distant perihelion of any known solar system object (80 au). It is likely a member of the inner Oort Cloud and is more tightly bound to the Sun than Sedna. 2012 VP_{113} is about 450 km in size with a moderately red color ($g - i = 1.02$ mags). Both 2012 VP_{113} and Sedna were found with perihelia greater than 75 au, even though surveys are more sensitive to closer and thus brighter objects between 50 and 75 au. This suggests there is an inner edge to the population around 75 au.

Finding additional Sedna-like objects will allow us to constrain the different formation scenarios of the Sednoids. These formation scenarios range from a rogue planet scattering objects, to stellar encounters while the Sun was in its birth cluster, to captured extrasolar planets. All these scenarios can be distinguished from one another once we have a handle on this populations orbital distribution. Understanding the formation scenarios for these objects has strong implications on the Sun's formation environment and our solar system's evolution.

We have also identified several extreme scattered disk and extreme detached disk TNOs that appear to have similar orbital characteristics as 2012 VP_{113} and Sedna. In particular, all have perihelia greater than Neptune, semi-major axes greater than 150 au and arguments of perihelion near zero degrees. As these objects spend most of their orbits well away from the giant planets, they are sensitive to perturbations from the very distant solar system. We take the similarity of their arguments of perihelion as possible evidence for some kind of perturber shepherding these objects into these similar angles.

Our survey also found 2013 FY_{27}, which is one of the ten largest known TNOs. We are currently determining the orbits of additional Sedna-like candidates found in our ongoing survey and will show an update during the 2014 Asteroids, Comets and Meteors meeting.

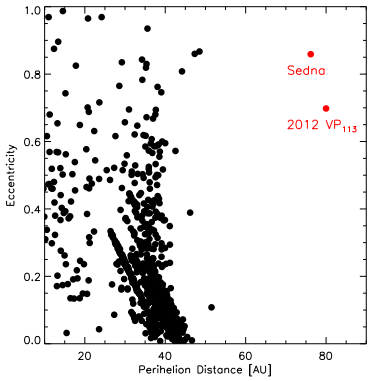

Figure: Perihelion versus eccentricity for all outer-solar-system objects with secure orbits. 2012 VP_{113} has the most distant perihelion of any known object at 80 au. 2012 VP_{113}, along with Sedna, are clear dynamical outliers. These two objects might be considered the first known members of the inner Oort cloud since their orbits are decoupled from the giant planets and are not significantly perturbed by the galactic tide.

Acknowledgements: This project used data obtained with DECam, which was constructed by the Dark Energy Survey collaborating institutions. Observations were in part obtained at Cerro Tololo Inter-American Observatory, National Optical Astronomy Observatory, which are operated by the Association of Universities for Research in Astronomy, under contract with the National Science Foundation. This paper includes data gathered with the 6.5 meter Magellan Telescopes located at Las Campanas Observatory, Chile. This research was funded by NASA Planetary Astronomy grant NNX12AG26G.