An Oort Cloud Analogue in an Extrasolar Protoplanetary Region?

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The collapse and fragmentation of protostellar discs to form planets has been extensively studied with numerical simulations, and by millimeter wave observations of gas and dust in protoplanetary disks. Cometary objects in the terrestrial Solar System are believed to be the placental debris left following giant planet formation in the outer Solar System, hurled outward to the terrestrial Oort Cloud by gravity-assists from the giant planets, galactic tides, and gravitational encounters with passing stars. Up to one thousand billion cometary bodies, constituting $\sim$ 40 Earth masses of solid material is currently believed to be incorporated into the terrestrial Oort cloud. We present new data showing the first detection in an extra solar star forming system of a shell of thermally excited methanol gas. The Methanol is concentrated in a rotating shell with a radius of $\sim$ 10,000 AU around the central protostars in the Lynds 1551 system. It has a rotational temperature of $\sim$ 6K, density of $\sim 10^4$–10^5 cm^{-3} and an enhanced (compared to molecular hydrogen at the center of the L1551 protostellar disk) abundance of 2×10^{-9}. As one of the main constituents of icy comets, we note that the methanol lies at a similar projected distance as the inner edge of the Solar System Oort Cloud, and is in principle available for incorporation into the Oort cloud cometary population. Comet sample return missions over the next few years will return primordial material for examination on the Earth. Will such material accurately represent the primordial conditions during planet formation, or of more processed material from the epoch of giant planet formation? Our detection of enhanced abundances in the L1551 Oort cloud analogue is used to critically examine the hypothesis that the fragmentation and coalescence of the protostellar disks around star formation regions may be able to provide a substantial body of material (at least in the L1551 case) to an Oort-like Cloud. We examine the implications for molecular abundances in material returned by future comet sample return missions.