CENTRE FOR STAR AND PLANET FORMATION

A research centre for cosmochemistry, astrophysics and astronomy

STARPLAN

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Research highlights for 2016

Unraveling the engine of a newly-formed star

Young stars form when dense cloud cores of gas and dust collapse due to the force of gravity. Newly-formed protostars are typically associated with powerful outflows and jets, but it has long been debated how such outflows and jets are launched in the first place. Using the supreme angular resolution of the ALMA telescopes, astronomers from StarPlan were for the first time able to resolve the regions around such a young star where the outflow is launched. They show that the outflow was launched as a extended wind lifted from the surface of the disk around the young star, which has important implications for understanding the mechanisms by which stars acquire their masses. These results were reported in the journal *Nature*.

An outer Solar System origin for metal-rich chondrites

Comets are pristine, volatile-rich bodies formed beyond the orbits of the gas giants and, thus, preserve a record of the material parental to our Solar System. Thus, a better understanding of these objects is critical for elucidating the origin of the terrestrial volatile element budget. Reporting in *PNAS*, Starplan scientists showed that a class of pristine chondrites, the metal-rich carbonaceous chondrites, has an isotope signature distinct from most Solar System planets and asteroids. This signature is consistent with that predicted for unprocessed primordial material, suggesting that – similar to comets – metal-rich carbonaceous chondrites are samples of asteroids that accreted in the outer Solar System. These objects thus provide a direct window into the formation history of the outer Solar System.

A new age for the Moon

The Pb isotopic composition of Earth's mantle cannot be reconciled with its age, the basis of the long-standing *Terrestrial Pb Paradox*. StarPlan scientists show that a giant Moon-forming impact between two sub-equal sized bodies 4.42 billion years ago would solve this paradox by volatizing Pb and, thereby, increasing the U/Pb ratio of Earth's mantle at this time. This revised age for the formation of the Moon is significantly younger than previous estimates but in excellent agreement with recent dating of lunar samples believed to the Moon's first crust at 4.36 billion years and the oldest samples from the early Earth currently dated at 4.37 billion years. These results were published in the journal *Earth and Planetary Science Letters*.