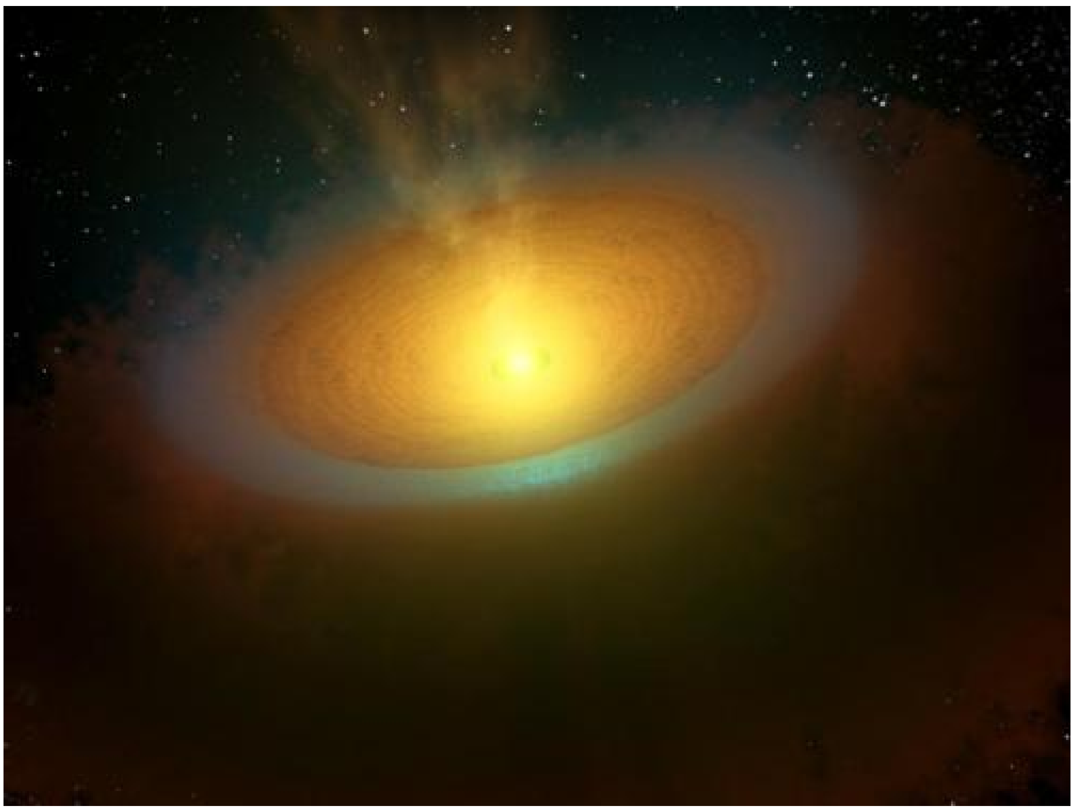
The water reservoir in a young planetary system

November 15 2011



An artist's conception of an icy, planet-forming disk around the young star TW Hydrae. Astronomers have used the Herschel Space Observatory to detect copious amounts of water ice in this source. Credit: NASA/JPL-Caltech

(PhysOrg.com) -- Astronomers once thought that the process of star formation was more-or-less controlled by the simple coalescence of material by gravity, leading eventually to a new star. But they have come to realize that star formation entails a very complex series of stages. In one early step, the young star assembles a circumstellar disk of gas and dust. After a few million years, this disk has matured enough to begin to develop into planets.

The star TW Hydrae, located about 150 light-years from Earth, is only about 10 million years old, and is currently in this planet-forming stage. Because TW Hydrae is relatively close and bright, and because it rotates with its pole pointed nearly directly towards the Earth, scientists can view the star's disk of material nearly face on to study what is happening. One outstanding puzzle is how rocky planets (like the Earth) can acquire their water. Most scenarios argue that the Earth's water arrived later on - via comets from the outer solar system. Thus a focus of recent astronomy has been the study of the composition of the outer parts of the young stellar disk.

CfA astronomer Gary Melnick, a leading expert on water in space, joined with a team of colleagues to use the new Herschel Space Observatory to look for traces of water around TW Hydrae. Writing in the latest issue of Science, the team reports finding convincing evidence for a reservoir of water ice in this star's disk -- with inferred quantities of water ice amounting to several thousand Earth-oceans. Moreover, they discovered from details of the ice chemistry that probably the ice comes from a mixture distributed throughout the system. The results lend convincing support to the current scenario of the origin of the Earth's oceans.

Provided by Harvard-Smithsonian Center for Astrophysics