CONTROL ID: 2253979

TITLE: A Mission to Study Water Throughout The Universe

ABSTRACT BODY:

Abstract Body: A variety of recent observations have revealed important new information about the distribution of water in the universe, and dramatically expanded its role as a tracer of key stages in the formation of stars and planetary systems. These include water in planetary atmospheres, an asteroid (Ceres), and comets in the solar system by Herschel and Rosetta. Observations of the protoplanetary disk TWHydra have revealed emission from water. Herschel observations of water in a collapsing cloud core (in combination with other molecular lines) have been able to determine the velocity field. Water has also been extensively studied in diffuse interstellar clouds and has been showed to be a valuable tracer of physical conditions and chemistry in these regions. A space mission dedicated to observations of water throughout the universe is appropriate and timely. A critical unifying characteristic of all of the above is that the line widths are very narrow and so high spectral resolution is essential. This means that for the water lines throughout the submillimeter spectral region, heterodyne systems are required. For such systems, the thermal emission from the telescope is negligible so a cold telescope is not necessary. Technology advances allow focal plane array systems with 16 and possibly 64 pixels to frequencies as high as 5 GHz. There have been significant reduction in system noise, but increasing the collecting area is the main way to significantly improve the sensitivity. We have been developing a concept for a space mission that will employ a 8m-9m diameter telescope with a suite of heterodyne focal plane array receivers and broadband digital spectrometers. The collecting area will be factor >5 greater than that of Herschel, and the angular resolution improved by a factor ~2.5. The telescope can be folded to allow a relatively low cost Falcon 9 launch. The surface accuracy should allow observations up to ~2 THz frequency, including a variety of ortho- and para-H_2O lines. Other key tracers of the interstellar medium such as C^+ and OI can also be covered, making this an enormously exciting concept for future studies of the solar system, the Milky Way, and nearby galaxies.

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