

New Search for Water in Planetary Systems

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In 1994 the world witnessed the much heralded collision of Comet Shoemaker-Levy 9 with Jupiter giving astronomers a unique opportunity to study the consequences of a catastrophic impact in a planetary atmosphere and the subsequent changes in the chemistry and in the excitation conditions of atomic and molecular species. One of the most important result from the ground based observations was the detection of water MASER emission at 22 GHz (Cosmovici et al.,1996,Planet.Space Sci.44.735) by using a new fast multichannel spectrometer coupled with the 32 m dish of the Medicina Radiotelescope, near Bologna, Italy. These observations were the first evidence that comets are able to deliver huge amounts of water (about 50 billion tons per comet) in planetary atmospheres thus rising the fascinating possibility of life development in an appropriate environment. Thus we decided to use this discovery as a powerful and unique diagnostic tool for water search in exoplanetary systems where cometary bombardments occur today as they occurred on our planet billion of years ago. Moreover calculations have shown that this MASER line can be observed also in water rich atmospheres where the necessary pumping can be delivered by photo-deposited energy which can affect the level populations.

Up to now 32 exoplanetary systems have been observed: suspect transient emissions have been identified from 4 stellar systems, but the low S/N ratio needs confirmation from other powerful telescopes with different methods. In order to improve the detection limits a new multichannel spectrometer was developed. It is a modular system: parallelising several boards it is possible to increase the bandwidth and the number of channels. The system is able to operate realtime FFTs (over bands narrower than 100 MHz) in parallel to KLTs (no real time) or other transforms. This instrument could play a key role in ordinary spectral line observations and in future applications requiring very high processing/computing power, dramatically increasing the on-line analysis performances.