STEAM (Stratosphere-Troposphere Exchange And climate Monitor)

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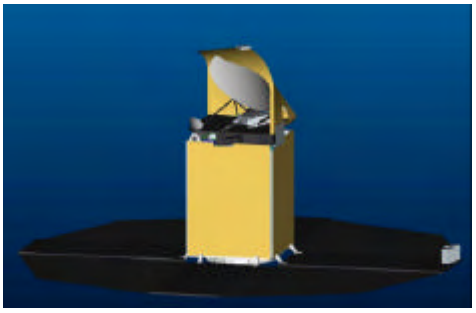
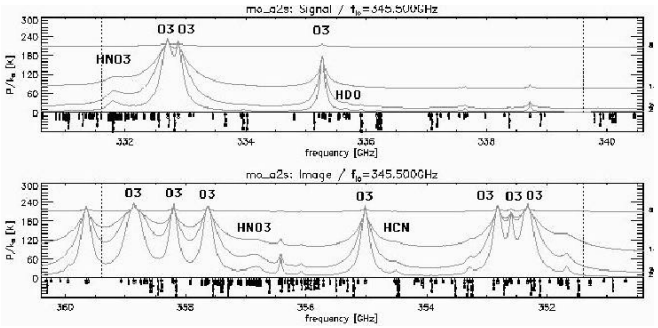
ABSTRACT

Mankind's influence on the atmosphere of the planet Earth has expanded in recent decades from the local scale of urban pollution to global scale effects such as the ozone hole. Global problems require global monitoring and global solutions.

The widespread use of 3D-models for predicting the effects of future changes in the atmosphere necessitates validation of the models with measurements.

STEAM is an explorer concept that can provide a unique global data set in the region 5-25 km by measuring, simultaneously, target species such as O3, H2O, ClO and CO within a very fine vertical grid (1-2 km) and a fine horizontal grid along the satellite track (30-50 km).





STEAM will measure molecular thermal emission spectra at sub-millimetre wavelengths. The instrument consists of a telescope that views thermal emission from the atmospheric limb imaged by a small linear array of receivers in the instrument platform. The incoming radiation from the Earth's limb is down converted in each mixer and amplified in low noise amplifiers. Spectrometers measure the spectral power density across each band.

Compared to Odin we do not foresee a need for power demanding active cooling and fundamentally pumped mixers. This makes it possible to build a very much-simplified system with mixers directly fed by the telescope and pumped via wave-guides. It is then possible to build a multi-beam system and use novel tomographic methods to overcome one major limitation of the current limb-scanning technique — the poor horizontal resolution.

The efficacy of topography has been successfully demonstrated using the Odin near-IR limb imager. To keep the crowding of the focal plane reasonable, not more than 8-12 mixers will be used. The reduction in sensitivity due to a non-optimum mixer configuration is compensated by the increase in integration time enabled by multiple mixers

The STEAM instrument will be presented on system level and key subsystems will be described in detail.

The same technology can meet the requirements for other proposed instruments, such as MASTER, CIWSIR and MAMBO. Implementations concepts for these instruments will also be presented.