ESPRIT - Exploratory submm Space Interferometric Telescope

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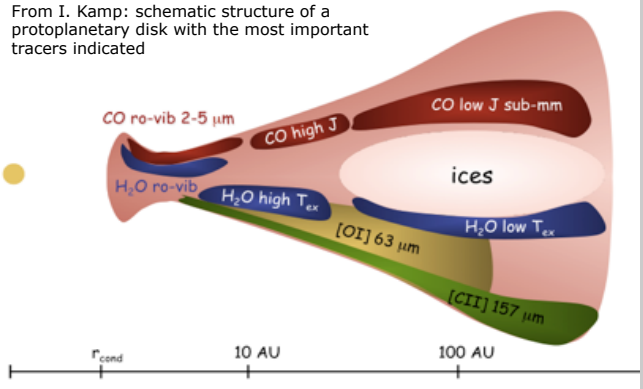
Abstract

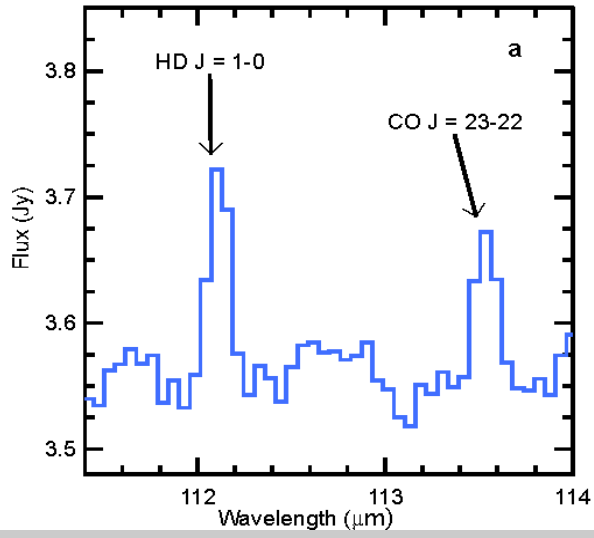
The most important science topic left by SPICA will be the evolution of protoplanetary disks into stars and planets. Only the combination of high spectral and high angular resolution observations of the gas in the disks can solve this scientific problem. ESPRIT is a heterodyne interferometer in space capable of measuring water, HD, high-J CO and the most important fine structure lines [CII], [OI] and [OIII]

Essentials

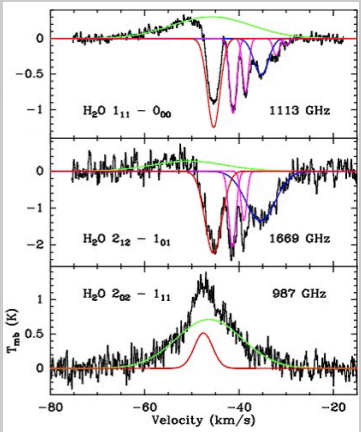
- ESPRIT consists of 4 or more telescopes drifting in a free flying configuration. Observing is done during the drifts
- ESPRIT is a heterodyne interferometer like ALMA
- ESPRIT employs state-of-the-art SIS and HEB mixers operating close to the quantum limit
- The spectral resolution is better than 1 km/s at 3 THz (100 micron)
- The u-v plane is filled because the satellites drift in and outwards by slightly different velocities
- Sensitivity is defined by the system temperature which is less than 1000K and the number of telescopes (and their surface area). For 6 elements (1 sigma, 1 hour) it is 4.5 K line brightness

From I. Kamp: schematic structure of a protoplanetary disk with the most important tracers indicated



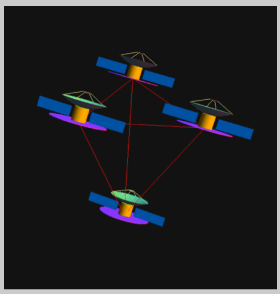


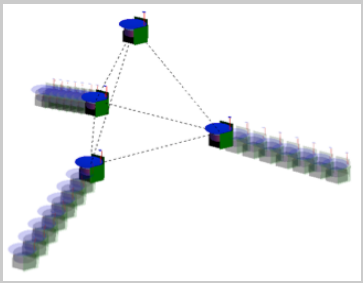
HD measured with Herschel/PACS in TW Hya (Bergin et al. Nature 2013). This was the only disk that could be probed by Herschel for this molecule



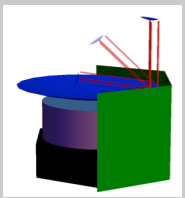
Envelope, broad and narrow outflow, foreground cloud components in IRAS 16272

Highlighting star-forming regions with water lines (Van der Tak et al. 2013)
The resolved water lines give the imprint of outflow, warm inner core, cold outer envelope and clous in the line-of-sight. If combined with high angular resolution the region could be sliced in small parts





Artist impressions of 4 elements (top) and drifting (left). Esprit elements are simple to reduce cost and to stack them in one rocket fairing



Conclusion
After SPICA the heterodyne interferometer is the ONLY viable solution to have high angular resolution and high spectral resolution and is thus the only concept suitable for in depth studies of the gas in proto-planetary disks