FISICA: engineering problems and system requirements for interferometric observations from the space

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In the 2000 Decadal Report "Astronomy and Astrophysics in the New Millennium" there is a strong recommendation for the development of a space far-IR *kilometer baseline* interferometer. Following this indications, in the framework of a NASA "vision mission" was studied an ambitious mission named SPECS (Submillimeter Probe of the Evolution of Cosmic Structure); this preliminary study was followed by two studies much more practical: SPIRIT, a new NASA study and FIRI an ESA mission, studies performed respectively in the 2003 and 2004. The last two missions consider an assembly of two 1m diameter telescope, separated to a common hub collector by means of a mechanical structure, permitting to vary the inter-telescopes distance. It is clear that all the considerations made in these preliminary studies and especially the one concerning the base concepts for a far-IR mission are general and can be retained as a base elements for the next far-IR study.

FISICA (Far Infrared Space Interferometer Critical Assessment) an FP7 program of the European community aims to bring together the leading international experts on FIR space instrumentation, in the effort to identify the scientific questions connected to an high spatial resolution observations in the FIR and to translate these into a technological definition of a space mission. To this scope will be studied and analyzed the technologies relevant to space interferometers which are at a low Technology Readiness Level. The outcome of this work will advance the knowledge and technology required for a future FIR mission, consolidate the scientific community and bring world-wide expertise to the EU consortium.

In this talk will be analyzed the technological problems related to the interferometer development, with particular emphasis in the possible use of accelerometers on board of the satellites that seems to offer the opportunity to implement a control loop algorithms, to keep the satellites in the appropriate positions during the observation time required to cover all the u,v plane, for each single source and to permit to measure the level of vibrational noise presents on them.

The gravity gradient acting on the system of satellites placed in the Lagrange point L2 (candidate for the positioning of the interferometer) is very small and so, the majority of accelerations presents on the interferometer are those due to its rotation performed around the ILS (Instrument Line of Sight) combined with the variation of the ITD (Inter Telescope Distance). In this condition, the accelerometers installed on the telescopes can measure directly their tangential acceleration, related to the ITD and to the angular acceleration (determinate by the star sensors); by means of a feed-back system, these informations can be used to control the thrusters, so to force the system to follow an opportune control law, for the variation of the ITD and angular velocity, giving the best condition for the acquisitions of the u,v points in the minimum time and best conditions.

Together with the analysis of the control laws for the telescopes of the interferometer, it has been conducting a study relating to metrological problems, with an investigation about the accuracies required in the measurement and/or determination of the relative distance between the telescopes and the requirements for levels of noise present on them, so as to keep the noise for the Optical Path Difference (piston, tilt and wave-front error) to the levels required for the visibility of the interferometer.

After explaining the general aspects related to the use of the accelerometer, will be shown the characteristics of an accelerometer which seems to meet the requirements for its use on board the interferometer and the preliminary work for the description of a test-bed with the use of a nano-satellite to demonstrate the functionality and of an accelerometer as basically element of a Far-Infrared and its Technology Readiness Level.