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BRAGG CELL PROGRESS FOR 2 GHz BANDWIDTH SPECTRUM ANALYSIS

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Abstract :

Introduction

Acousto-optical Bragg cells are key components for wideband submillimetric spectral analysis modules. Among the major interests of this well known technology, we can pick out a very wideband instantaneous bandwidth, a good resolution, and high dynamic range (in case of interferometric set up). The anisotropic diffraction Bragg cell family provides all the more two crucial advantages : one in reducing the ultimate noise level of the analyser by polarisation filtering of the incident optical beam induced diffusion noise (non polarisation rotated), and the second one by improving the time stability (Allan Variance) of transfer function. These properties has been successfully exploited for years in astronomical applications with our standart 1 GHz bandwidth CBA 011 space qualified Bragg Cells.

Due to the growing demand on wider band analysis, several analysers are to be used in parallel to cover the total desired bandwidth. In order to reduce the volume, weight, and consumption of the analyser as a whole, it is very efficient to enhance the individual bandpass of each Bragg cell of the analyser. We present in this poster the preliminary results obtained in the first phase of a study cofinanced by CNES to improve the efficiency of 2 GHz bandwidth Bragg cells.

Results

New technological investigations of the device have been performed with direct mesurement of admittance under wideband RF micro probes (0-20 GHz) without any connecting wire. Several transducer's thicknesses and different electrode shapes and sizes (square, diamond-shaped) have been tested. Diamond-shaped electrodes have been proven to provide a better efficiency as refered to there longer interaction lenght for a given input RF density power. Then an antiresonant mode in relation to the thickness of the metallized electrode has been found to reduce the bandwidth of the cell. Further more the connecting air bridge used to report connection from the very small active electrode to a bigger patch acts as a massive acoustic load on the transducer. Then the angular spectrum of diffraction is no longer that of the homogeneous vibrating plate.

New design of the cell and modification of some of the technological parameters led to improved performances complying with CNES requirements. We have obtained a 9%/WRF efficiency, 2.4 GHz bandwidth Bragg cell centered at 3.4 GHz and measured at $\lambda = 633$ nm optical wavelenght. These performances fulfill the specifications needed for an efficient 2 GHz spectrum analyser intended for radio astronomical applications

Conclusion

Highly improved efficiency has been obtained on >2GHz bandwidth Bragg cell for RF spectrum analysis. Some 2 GHz acousto-optical spectrum analysers are currently under developpement. The present work is oriented towards technological stabilization of the process and demonstration of reproducibility.