# 1.1 THz Multi-pixel Heterodyne Receiver for APEX

N. Hurtado[1*], U. U. Graf[1], C. E. Honingh[1], K. Jacobs[1], M. P. Westig[1], R. Güsten[2] and J. Stutzki[1]
[1] *KOSMA, I. Physikalisches Institut, Universität zu Köln, Zülpicher Str. 77, 50937 Köln, Germany*
[2] *Max-Planck-Institut für Radioastronomie (MPIfR), Auf dem Hüge 69, 53121 Bonn, Germany*
* Contact: hurtado@ph1.uni-koeln.de, phone +49-221-470 3549
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***Abstract*— We present the current development of a 9 pixel 1.1 THz heterodyne receiver for APEX in the Atacama Desert, Chile. The multi-pixel receiver greatly enhances the science output under the difficult observing conditions in this wavelength regime.**

**In a heterodyne array receiver, each detector beam has to be collimated individually before combining the beams in the common optics. This task is performed by the focal plane unit (FPU) modeled after the CHARM (Compact Heterodyne Array Receiver Module)[1] concept. The FPU consists of 3x3 pixels, each of them formed by a two mirror collimator arranged as an off-axis Cassegrain system and a feed horn. We employ a monolithic integrated optics approach, so no internal optics alignment is required.**

**The 1.1 THz focal plane array optics has been designed and is being built in our workshop. We performed simulations of the beams at the current frequency. We are confident that the simulations predict the performance correctly, because a similar design of the focal plane for 345 GHz was successfully built and tested. Its near field pattern simulations and measurements agreed very well. In this setup the large collimation mirrors and thus the beams, are arranged on a rectangular grid, with the feed horns and small illumination mirrors located in the gaps between the individual collimation mirrors/beams. The collimator was optimized to keep the mirrors as flat as possible; this together with the small reflection angles of 38° minimizes optical aberrations.**

**The LO power distribution is accommodated behind the FPU. A collimating Fourier grating[2] splits the LO beam in three identical beams which get coupled to three feed horns in the LO distribution plate at the rear side of the FPU. Each horn feeds a coupler structure, that supplies the LO power for a row of 3 mixers, thus supplying LO signal to all 9 pixels of the array. Different possibilities of the LO coupling design/fabrication are being analyzed and will be based on in-house hybrid waveguide/planar technology. The LO coupler is interfaced with balanced mixers, probably of a similar design as the on chip balanced SIS mixer at 490 GHz that is developed in our institute.**

**Two similar self-contained 3x3 beam receiver cartridges - one per polarization - will be installed in the cryostat and thus form the entire receiver. To accommodate the cartridges in the cryostat, we are developing a new simple thermal link[3,4] without screws to connect the cartridges to the cryostat.**

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