The upGREAT THz Arrays for SOFIA: Successful Commissioning at 1.9 THz

C. Risacher[1*], R. Güsten[1], J. Stutzki[2], H.-W. Hübers[3], P. Pütz[2], A. Bell[1], D. Büchel[2], I. Camara[1], R. Castenholz[1], M. Choi[1], U.U. Graf[2], S. Heyminck[1], C. E. Honingh[2], K. Jacobs[2], M. Justen[2], B. Klein[1,4], T. Klein[1], C. Leinz[1], N. Reyes[1,5], H. Richter[3], O. Ricken[1], A. Wunsch[1]

[1]*Max Planck Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany*
[2]*KOSMA, I. Physikalisches Institut, Universität zu Köln, Zülpicher Strasse 77, 50937 Köln, Germany*
[3]*German Aerospace Center (DLR), Institute of Planetary Research, Rutherfordstr. 2, Berlin,Germany*
[4]*European Southern Observatories, Vitacura, Santiago de Chile, 19001, Chile*
[5]*Universidad de Chile, Santiago, Chile*
* Contact: crisache@mpifr.de

We present the upGREAT heterodyne arrays for astronomy, used with the SOFIA airborne observatory, a 2.5-m telescope flying on a NASA/DLR Boeing 747. The upGREAT array receivers operate in two different frequency ranges, the low frequency array (LFA) covering the 1.9-2.5 THz band with 14 pixels, and the high frequency array (HFA)targeting the 4.745 THz line of atomic oxygen [O I] with 7pixels. The frontend uses superconducting Hot Electron Bolometers (HEB) waveguide devices as mixers. The local oscillators are based on commercial synthesizer driven solid-state multiplier chains for the LFA and a quantum cascade laser for the HFA. Both receivers are cooled using closed cycle pulse tube refrigerators, reaching temperatures below 4K.

The upGREAT LFA receiver, with its 14 channels, was successfully commissioned in May and December 2015. We will present the main results of the commissioning flights. At 1.9 THz the array performed nominally on sky, with state of the art performance for 12 out of 14 pixels, reaching about 600-800 K DSB uncorrected receiver noise temperature at 0.5 GHz IF with an IF noise bandwidth of ~3.5 GHz. The stability was excellent and allowed efficient large scale mapping, demonstrating already that a factor of 10 was gained in time efficiency compared to the previous single pixel receiver at 1.9 THz. We are currently integrating the HFA for the planned commissioning flights in October-November 2016 and will present preliminary performance data measured during integration at the MPIfR.

This work was supported in part by the Federal Ministry of Economics and Technology via the German Space Agency (DLR) under Grants 50 OK 1102, 50 OK 1103 and 50 OK 1104 and by the Collaborative Research Council 956, sub-projects D3 and S, funded by the Deutsche Forschungsgemeinschaft (DFG).