# T2E

# Kinetic Inductance Detectors with integrated antenna's for ground and space based sub-mm astronomy

*A. Baryshev[1],J.J.A. Baselmans[2], S. Yates[2], A. Neto[3], D. Bekers[3], G. Gerini[3], Y.J.Y. Lankwarden[2], Bernd Klein[5], R. Barends[4], H. Hoevers[2], T.M. Klapwijk[4]*

*1 SRON Netherlands Institute for Space Research, Landleven 12, 9747 AD Groningen, The Netherlands*
*2 SRON Netherlands Institute for Space Research, Sorbonnelaan 2, 3584 CA Utrecht, The Netherlands*
*3 TNO - Defence, Security and Safety , Oude Waalsdorperweg 63, 2597 AK, The Hague, The Netherlands*
*4 Kavli Institute of Nanoscience, Delft University of Technology, Lorentzweg 1, 2628 CJ Delft, The Netherlands*
*5 Max-Planck-Institut für Radioastronomie, Auf dem Hügel 6953121 Bonn, Germany*
Contact: A.M.Baryshev@sron.nl, phone +31-50-363 8287.

***Abstract*— Very large arrays of Microwave Kinetic Inductance Detectors (MKIDs) have the potential to revolutionize ground and space based astronomy. They can offer in excess of 10.000 pixels with large dynamic range and very high sensitivity in combination with very efficient frequency division multiplexing at GHz frequencies. In this paper we present the development of a 400 pixel MKID demonstration array, including optical coupling, sensitivity measurements, beam pattern measurements and readout. The design presented can be scaled to any frequency between 80 GHz and >5 THz because there is no need for superconducting structures that become lossy at frequencies above the gap frequency of the materials used. The latter would limit the frequency coverage to below 1 THz for relatively high gap materials such as NbTiN.**

**An individual pixels of the array consist of a distributed Aluminium CPW MKID with an integrated twin slot antenna at its end. The antenna is placed in the in the second focus of an elliptical high purity Si lens. The lens-antenna coupling design allows room for the MKID resonator outside of the focal point of the lens. The best dark noise equivalent power of these devices is measured to be NEP = $7 \cdot 10^{-19}$ W/√Hz and the optical coupling efficiency is around 30%, in which no anti-reflection coating was used on the Si lens. For the readout we use a commercial arbitrary waveform generator and a 1.5 GHz FFTS. We show that using this concept it is possible to read out in excess of 400 pixels with 1 board and 1 pair of coaxial cables.**