Lens coupled Leaky wave antennas

During this ERC, several novel antennas in the submillimeter-wave range have been successfully developed exploiting the unique radiation properties of leaky-wave resonant antennas for bandwidths up to 1:2. We developed leaky-wave antennas based on a Fabry-Perot cavity radiating into a dense medium, originally proposed in [1]. This cavity ensures that the radiation from the feed antenna into the dense medium is confined below the critical angle enabling the efficient excitation of lenses. In this ERC we have explored the design of advanced lens antennas with broadband and wide steering angles combining this leaky-wave antenna with advanced field matching techniques. Moreover, we have investigated the use of non-uniform dielectric structures for further tuning the radiation properties in different sensing and communication applications.

In the THz spectral band, there is a great interest in realizing imaging systems with extremely wide-bandwidths (>1:2 BW). For such wide-bandwidths, the non-resonant leaky lens antennas, originally introduced by Prof Neto in [2], are instead the excellent candidates to couple to a Quasi-Optical Imaging System. In this ERC, we have explored ultra large bandwidth imaging architectures based on this antenna. What is the difficulty in making a wideband QoS? The field in the focus of a lens is dispersive in frequency, the energy is confined in a space whose dimension is proportional to the wavelength. Therefore an antenna placed at the focus should have a receiving area that changes with the frequency. Even if the antenna radiates over a wide-band efficiently, a proper field match to the QO system field is still needed. A wideband field match via near-field focused lenses in the non-diffractive region of the QoS is investigated in the framework of this ERC.

[1] N. Llombart, G. Chattopadhyay, A. Skalare and I. Mehdi, "Novel Terahertz Antenna Based on a Silicon Lens Fed by a Leaky Wave Enhanced Waveguide," in IEEE Transactions on Antennas and Propagation, vol. 59, no. 6, pp. 2160-2168, June 2011, doi: 10.1109/TAP.2011.2143663.

[2] A. Neto, "UWB, Non Dispersive Radiation From the Planarly Fed Leaky Lens Antenna—Part 1: Theory and Design," in IEEE Transactions on Antennas and Propagation, vol. 58, no. 7, pp. 2238-2247, July 2010, doi: 10.1109/TAP.2010.2048879.