2nd URSI AT-RASC, Gran Canaria, 28 May – 1 June 2018

Bull's-Eye antennas and corrugated structures for radiation control at terahertz

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The field of plasmonics was revitalized after the discovery of Extraordinary Optical Transmission (EOT) through subwavelength hole arrays done by Ebbesen et al. in 1998 [1] working in the infrared range. These unexpected high transmittance peaks appear in the cutoff region of the holes and were explained as the coupling of the incident wave to surface plasmons supported by the perforated plate.

This result was the inspiration to find other structures with similar performance but reducing the number of holes to a single aperture. To achieve the high transmittance, the aperture was surrounded by periodic corrugations and in the case of annular shaped grooves the geometry was called "Bull's-Eye" [2]. It is noteworthy that EOT has been found in other regions of the electromagnetic spectrum such as millimeter-waves of terahertz (THz) [3], [4]. Likewise, antennas based on "Bull's-Eye" structures have been successfully demonstrated, giving rise to a new family of antennas [5], [6].

In this talk, I will summarize our latest achievements regarding "Bull's-Eye" antennas considering high aperture efficiency [7] as well as other topologies. I will also consider some new ideas stemming from corrugated structures, such as multiple grooves for wideband backscattering reduction [8].

1. T. W. Ebbesen, H. J. Lezec, H. F. Ghaemi, T. Thio, and P. A. Wolff, "Extraordinary optical transmission through sub-wavelength hole arrays," Nature, vol. 391, pp. 667–669, Feb. 1998.

2. H. J. Lezec et al., "Beaming light from a subwavelength aperture," Science, vol. 297, no. 5582, pp. 820–822, Aug. 2002.

3. M. Beruete et al., "Enhanced millimeter-wave transmission through subwavelength hole arrays," Opt. Lett., vol. 29, no. 21, pp. 2500–2502, Nov. 2004.

4. S. A. Kuznetsov et al., "Regular and anomalous extraordinary optical transmission at the THz-gap," Opt. Express, vol. 17, no. 14, pp. 11730–11738, Jul. 2009.

5. M. Beruete et al., "Very Low-Profile 'Bull's Eye' Feeder Antenna," IEEE Antennas Wirel. Propag. Lett., vol. 4, no. 1, pp. 365–368, 2005.

6. M. Beruete et al., "Terahertz Corrugated and Bull's-Eye Antennas," IEEE Trans. Terahertz Sci. Technol., vol. 3, no. 6, pp. 740–747, 2013.

7. U. Beaskoetxea and M. Beruete, "High Aperture Efficiency Wide Corrugations Bull's-Eye Antenna Working at 60 GHz," IEEE Trans. Antennas Propag., vol. 65, no. 6, pp. 3226–3230, Jun. 2017.

8. B. Orazbayev, P. Rodríguez-Ulibarri, and M. Beruete, "Wideband backscattering reduction at terahertz using compound reflection grating," Opt. Express, vol. 25, no. 19, pp. 22905–22910, 2017.