



COST ACTION CA18223

**SYMAT**

FUTURE COMMUNICATIONS WITH  
HIGHER-SYMMETRIC ENGINEERED  
ARTIFICIAL MATERIALS



**cost**  
EUROPEAN COOPERATION  
IN SCIENCE & TECHNOLOGY

## **Report of SyMat (CA18223) COST Action Activities October 2020 – October 2021**

Main Chair: Prof. Guido VALERIO

### **Convened Session and Booth at EuCAP 2021**

SyMat organized a convened session at EuCAP. Chairwomens of the sessions were Prof. Eva Rajo-Iglesias (University Carlos III of Madrid, Spain) and Prof. Francesca Vipiana (Politechnic of Turin, Italy)

The ten papers submitted and presented at the session are available in the reserved area of the SyMat website.

A dissemination booth was also organized and managed by Mr. Boris Ficher (Sorbonne University, France), Ms. Pilar Castillo-Tapia (KTH, Sweden) and Ángel Palomares-Caballero (University of Granada, Spain).

### **On-line Scientific and MC meeting, Paris, France**

**14 April 2021**

The third MC meeting took place on-line, organized by Prof. Guido Valerio (Sorbonne University, France). The minutes of the MC meeting are available in the reserved area of the SyMat website.

### **Convened Session at URSI GASS 2021, Rome, Italy**

**3 September 2021**

After one year and a half, SyMat organized again a physical meeting, as a convened session at the URSI GASS 2021 conference in Rome, Italy. Organizers of the session were Prof. Guido Valerio (Sorbonne University, France) and Dr. Simon Horsley (University of Exeter, UK). Chairmen were Prof. Guido Valerio (Sorbonne University, France) and Prof. Oscar Quevedo-Teruel (KTH, Sweden).

The six papers submitted and presented at the session are available in the reserved area of the SyMat website.



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## Training Event “Exploiting symmetries in artificial materials for antenna applications”, Paris, France

### 13-16 September 2021

A hybrid training event was organized at Sorbonne University for PhD students. The summer school “Exploiting symmetries in artificial materials for antenna applications” was part of the network of the European School of Antennas (ESoA). 23 trainees attended in site and 22 attended on-line. 7 trainers participated in site and five on-line. The material of the course has been made available to all the participants.

## On-line Scientific and MC meeting, Paris, France

### 5 October 2021

Three scientific presentations followed by the fourth MC meeting took place on-line, organized by Prof. Guido Valerio (Sorbonne University, France). New rules for COST Actions have been presented together with a proposal for the budget of the upcoming Grant Period. No decision has been taken during this meeting. The scientific presentations and the presentation of the MC meeting are available in the reserved area of the SyMat website.

## STSM October 2020 – October 2021

Four STSM took place in the period between October 2020 and October 2021.

1. Dr. Mauro Ettore (CNRS, France) visited Profs. Zvonimir Sipus and Marko Bosiljevac (University of Zagreb), 18/10/2020 to 23/10/2020.  
Title: “Future communications with higher-symmetric engineered artificial materials”. The visit was aimed at starting a new collaboration for the analysis and design of wideband wide scan LP-CP polarizers over conformal surfaces using higher-symmetry concepts. Results of the STSM will be presented at SyMat scientific meeting planned in 2022.
2. Prof. Francisco Mesa (University of Seville, Spain) visited Prof. Oscar Quevedo-Teruel (KTH, Sweden), 3/05/2021 to 13/06/2021.  
Title: “Use of higher symmetries in advanced communication systems”. The visit was aimed at the extension of the Multi-Modal Transfer-Matrix Method (MMTMM) to obtain the dispersion diagrams of 3-D periodic structures, possibly allowing for inhomogeneities of the input/output ports of the unit cells. Results of the STSM will be presented at SyMat scientific meeting planned in 2022.
3. Dr. Walter Fuscaldo (CNR, Italy) visited Dr. Mauro Ettore (CNRS, France), 15/06/2021 to 04/07/2021.



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Title: "Millimeter-wave generation of localized beams through higher-symmetric metasurfaces". The visit was aimed at the use of glide-symmetric metasurfaces in 1-D radially periodic leaky-wave antennas at mm-waves and to explore applications of self-healing Bessel beams. Results of the STSM will be presented at SyMat scientific meeting planned in 2022.

4. Mr. Dayan Pérez Quintana (CNR, Italy) visited Prof. Oscar Quevedo-Teruel (KTH, Sweden), 01/09/2021 to 01/10/2021.

Title: "Design of antennas and metasurfaces using Glide Symmetry and Gap Waveguide technology". The visit was aimed at the use of glide-symmetric metasurfaces for the feeding of geodesic lenses. Results of the STSM will be presented at SyMat scientific meeting planned in 2022.

### Journal Papers November 2019 – September 2020

Q. Chen, F. Giusti, G. Valerio, F. Mesa, and O. Quevedo-Teruel, "Anisotropic glide-symmetric substrate-integrated-hole metasurface for a compressed ultrawideband Luneburg lens," *Appl. Phys. Lett.*, 118, 084102, 2021. doi: 10.1063/5.0041586

P. Castillo-Tapia, K. Van Gassen, Q. Chen, F. Mesa, Z. Sipus, and O. Quevedo-Teruel, "Dispersion analysis of twist-symmetric dielectric waveguides," *Photonics*, 8, 206, 2021. doi:10.3390/photonics8060206

O. Quevedo-Teruel, Q. Chen, F. Mesa, N. J. G. Fonseca and G. Valerio, "On the benefits of glide symmetries for microwave devices," in *IEEE Journal of Microwaves*, vol. 1, no. 1, pp. 457-469, Jan. 2021, doi:10.1109/JMW.2020.3033847.

P. Castillo-Tapia, F. Mesa, A. Yakovlev, G. Valerio, and O. Quevedo-Teruel, "Study of forward and backward modes in double-sided dielectric-filled corrugated waveguides," *Sensors*, 21, 6293, 2021. doi:10.3390/s21186293

O. Tsilipakos, L. Maiolo, F. Maita, R. Beccherelli, M. Kafesaki, E. E. Kriezis, T. V. Yioultsis, and D. C. Zografopoulos, "Experimental demonstration of ultrathin broken-symmetry metasurfaces with controllably sharp resonant response," accepted on *Appl. Phys. Lett.*, 2021. doi:10.1063/5.0073803

### Other Relevant Papers October 2020 – October 2021

Q. Chen, F. Mesa, X. Yin, and O. Quevedo-Teruel, "Accurate Characterization and Design Guidelines of Glide-Symmetric Holey EBG," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 68, no. 12, pp. 4984-4994, Dec. 2020, doi: 10.1109/TMTT.2020.3023751.

A. Alex-Amor, F. Ghasemifard, G. Valerio, M. Ebrahimpouri, P. Padilla, J. M. Fernández González, and O. Quevedo-Teruel, "Glide-Symmetric Metallic Structures With Elliptical Holes for Lens Compression," in *IEEE Transactions on Microwave Theory and Techniques*, vol. 68, no. 10, pp. 4236-4248, Oct. 2020, doi: 10.1109/TMTT.2020.3011004.

F. Mesa, G. Valerio, R. Rodríguez-Berral and O. Quevedo-Teruel, "Simulation-Assisted Efficient Computation of the Dispersion Diagram of Periodic Structures: A comprehensive overview with



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applications to filters, leaky-wave antennas and metasurfaces," in *IEEE Antennas and Propagation Magazine*, vol. 63, no. 5, pp. 33-45, Oct. 2021, doi: 10.1109/MAP.2020.3003210.

J. -M. Poyanco, O. Zetterstrom, P. Castillo-Tapia, N. J. G. Fonseca, F. Pizarro and O. Quevedo-Teruel, "Two-Dimensional Glide-Symmetric Dielectric Structures for Planar Graded-Index Lens Antennas," in *IEEE Antennas and Wireless Propagation Letters*, vol. 20, no. 11, pp. 2171-2175, Nov. 2021, doi: 10.1109/LAWP.2021.3092169.

K. Neophytou, M. Steeg, A. Stohr, and M.A. Antoniadis, "Compact Folded Leaky-Wave Antenna Radiating a Fixed Beam at Broadside for 5G mm-Wave Applications," *IEEE Antennas and Wireless Propagation Letters*, 2021

K.M. Kossifos and M.A. Antoniadis, J Georgiou, "Agile and Multifunctional Integrated-Circuit-Enabled Metasurface", in *Proc. 2021 International Applied Computational Electromagnetics Society Symposium*, 2021.

K.M. Kossifos, M.A. Antoniadis, J. Georgiou, "ASIC-Enabled Reconfigurable Metasurfaces for 5G Applications," in *Proc. 15th European Conference on Antennas and Propagation (EuCAP)*, 2021.