Université Lille Nord de France
Pôle de Recherche et d'Enseignement Supérieur

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Titre Thèse	**Metasurface Sensitive Covid-19 Bio-Detectors**	
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The current COVID-19 pandemic has spread rapidly across the world, with some emerging variants spreading more quickly and more easily. The key to fighting a virus as destructive as COVID-19 is to isolate infected patients to inhibit community spread. However, identifying infected patients has been challenging due to poor quality of testing kits, slow diagnostic results, and an overall shortage of testing. The current gold-standard COVID-19 diagnostic method uses reverse transcription-polymerase chain reaction (RT-PCR). However, RT-PCR requires careful handing, storage at 2-8°C, biosafety level 2 laboratories, and single use reagents. There is a need for novel diagnostic methods to detect infectious diseases in order to overcome the current limitations associated with RT-PCR.

A viable alternative for COVID-19 identification is use of sub-wavelength all-dielectric metamaterials (ADMs) which support high quality factor (Q-factor) spectral features. These sharp resonances may be used for sensitive bio-detection, due to their inherent sensitivity to their dielectric background. For example, the ADM structures are highly responsive to changes in the refractive index, and thus any biomolecules near their surface, will cause a shift in the spectral feature. The shifting of high-Q modes results in a huge change in the transmitted wavelength, thus providing highly sensitive detection capability. Covid-19 specificity will be achieved by using a functionalization agent which will allow adsorption of a specific biomolecular analyte. We will engage in a computational, fabricational, and spectroscopic investigation of the ability of specific modes in ADMs to investigate their potential for sensitive biodetection.

Willie Padilla is a Professor at **Duke University (USA)**. He is a one of the world leaders in the fields of **Metamaterials and Metasurfaces** and particularly at **Terahertz** frequencies. He is also a world expert in the fields of **imaging**, and **deep learning** for **energy harvesting** and **metasurface based biodectors.**
(h-index=61 and more than 39 500 citations).
https://scholar.google.fr/citations?user=5mFPlG0AAAAJ&hl=fr&oi=ao

Tahsin Akalin is an Associate Professor. He is an expert in the field of **terahertz** electromagnetic waves, photonics, **plasmonics**, Planar Goubau Lines, antennas, **metasurfaces** including for **biosensing** applications and wireless communications (5G, 6G and beyond).
(h-index=22 and more than 2 000 citations).
https://scholar.google.fr/citations?user=YFx_xtsAAAAJ&hl=fr&oi=ao