# Surface plasmon localization on field emitters arrays for microwave modulation of tunneling currents

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We present the first steps for the validation of a novel photocathode concept. This approach relies on the interaction of surface plasmons polaritons with vertically aligned multi-wall carbon nanotubes [1] or metallic nanowires arrays. The photocathode is submitted to a static and an optical electric field, these fields being aligned with the nanoemitters. The objective is to induce a modulation of the field emission current by using the optical component at the field emitter apex through antenna coupling [2, 3, 4]. However, practical implementation of this concept on arrays of nanoemitters requires a quasi-perpendicular illumination of the surface. In this case, the optical E field orientation is perpendicular to the static E field and is thus inefficient. We propose to use a specific surface metallic micro-structure around rows of emitters to change the incident E field polarization. These gratings are one-dimensional metallic surface cavities which allows one to couple a laser beam under perpendicular incidence with a localized surface mode. This mode provides an enhancement of the field intensity along two lines where the emitters will be disposed. Finite Difference in Time Domain computations allows us to optimize the field enhancement of such structures which have been recently realized via electron-beam lithography. Traversal time for tunneling in field emission processes (around $10^{-15}$s) makes this technology compatible with modulation of electronic beams at least up to THz frequencies. As a result, the use of a near-infrared monomode laser should lead to the generation of microwave modulation of electronic beams in forthcoming experiments.

# References

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