Integrated Photonic Assisted Emission Devices

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Electron Sources Application

Electron emission devices are used in an array of devices that requires high power & high speed electron source such as:
- Free electron lasers
- Time resolved electron microscopy
- Vacuum electronic high power THz sources

Integrated Photonic Solution

With recent advances on integrated photonics, we propose for the first time using optical cavity adjacent to electron emitter to enhance the optical absorption for power efficient electron source. In addition, integrated high speed switches allow high speed control on the generated electron beam.

Calculations on Cavity Assisted Emitter

- Optical mode evanescently couple to emitter.
- Optical absorption enhances up to 10X. [1]

Experiment: Hybrid Emitter

- We built an emission setup including guiding optics inside vacuum chamber.
- We fabricated the hybrid LaB$_6$ / Graphene electron emitter on sharp tip silicon array in which LaB$_6$ reduced the surface work-function to 3.62 eV and we obtained field enhancement via sharp silicon tip. [2]

Experiment: Waveguide Assisted Emitter

- We observed photo-current at E-field as small as 0.2 V/µm.
- Photo-current demonstrated strong dependency on laser power. Current versus laser power curve is indicating two-photon process.

References


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