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Picometer scale emittance from plasmonic spiral photocathode for particle accelerator applications

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In this work we demonstrate the generation of a record low root mean square normalized transverse electron emittance of less than 30 pm-rad from a flat metal photocathode –more than an order of magnitude lower than the best the emittance that has been achieved from a flat photocathode. This was achieved by using plasmonic focusing of light to a sub-diffraction regime using plasmonic Archimedean spiral structures resulting in a ~ 40 nm root mean square electron emission spot. Such nanostructured electron sources exhibiting simultaneous spatio-temporal confinement to nanometer and femtosecond level along with a low mean transverse energy can be used for developing advanced electron sources to generate unprecedented electron beam brightness for various accelerator applications.

Footnotes

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