



Contribution ID: 121

Type: **Invited talk**

Multivariable and Multiindex Bessel Functions: A computational tool for Electromagnetic Processes

Thursday, October 9, 2014 12:30 PM (30 minutes)

Scattering processes which cannot be treated in dipole approximation demand for the use of analytical tools going beyond the ordinary special functions and in particular beyond the use of cylindrical Bessel function of first kind. The emission of radiation by relativistic electrons in linearly magnetic undulator and the scattering by intense laser radiation as well require the use of “new” forms of Bessel functions, with many variables, which, albeit introduced in the last century, are not widespread popular as they should be.

Their use in QED and in processes associated with multi-photon ionization has been proven to be extremely useful and capable of providing the relevant physical quantities in an extremely concise and easily computable form.

Other forms of “exotic” Bessel functions concerning the case with many indices provides a powerful computational tool for processes involving the emission by charged particles interacting with multi-frequency oscillating fields or in magnetic structures like undulators with different periods.

In this seminar we review the essential properties of these families of special functions, their relationship with the ordinary forms and their use for specific applications.

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Session Classification: S5: Novel Sources: FEL/Laser/Plasma Channels