Toroidal Decomposition of Magnetic Field

“Multipole expansions” are often used to describe field maps in a continuous way which also obey Maxwell’s equations, for highly accurate particle tracking. To perform this description in a bend (in a “toroidal multipole”), we must compute Associated-Legendre Polynomials. We have a script which can do this in Fortran, but for use in our particle-tracking codes it must be translated to Python and C++. The student will convert this script to both languages, thoroughly testing all cases for all functions. Following this, we will integrate it into a script to calculate the toroidal-multipole coefficients which describe an input field map and quantify the gain in term of computational speed and accuracy of this new method.