

## **TALENT Course 6: Theory for exploring nuclear reaction experiments**

### **Outline project proposal**

**Project name:** Derivation of the first and second order perturbation solution in semi-classical scattering with CC method in coulomb excitation

**Researcher(s):** Jean-Francois Lemaître

**Affiliation:** CEA/Irfu/SPhN, centre de Saclay, France

**Supervisor(s):** A. Moro

#### **Project outline and aims:**

The aim is to estimate the error due to the approximation at first order perturbative solution of the wave function of scattered projectile in semi-classical approach. In the case of Coulomb excitation, we identify cases where this approximation is not valid so where second order expansion is needed.

#### **Methodology:**

Projectile trajectory is determined in classical framework, where it is characterized by the polar variables. We include explicitly the internal structure of the projectile in the total Hamiltonian. We use coupled-channels method to obtain time-dependent solutions from Schroedinger equation in the perturbation theory framework. When the first and second order perturbative solutions are obtained, we applied in the case of Coulomb excitation to have the amplitude of first and second order solutions.

#### **Key references:**

1. M.V. Andrs, J. Gomez-Camacho, M.A. Nagarajan, Nucl. Phys. A579 (1994) 273-284.
2. J. Gomez-Camacho, M.V. Andrs, M.A. Nagarajan, Nucl. Phys. A580 (1994) 156-172.
3. M.V. Andrs, J. Gomez-Camacho, M.A. Nagarajan, Nucl. Phys. A583 (1995) 817-820.