Abstract: The dynamic of three one dimensional non relativistic spinless quantum particles interacting through delta potentials is governed by the Hamiltonian

\[ \sum_{i=1}^{3} -\frac{\Delta_i}{2m_i} + \sum_{1 \leq i < j \leq 3} Z_i Z_j \delta(x_i - x_j) \quad \text{acting} \quad \bigotimes_{i=1}^{3} L^2(\mathbb{R}) \]

where \( x_i \in \mathbb{R} \) denotes the position of the \( i^{th} \) particle, \( \Delta_i := \partial^2_{x_i} \), \( m_i > 0 \), \( Z_i \in \mathbb{R} \) the mass and the charge of this \( i^{th} \) particle. The question we address is: for what values of the masses and the charges does this Hamiltonian possess a bound state, i.e. a discrete eigenvalue. We shall give a fairly complete picture in the particular case, \( m_1 = M > m_2 = m_3 = m \), \( Z_1 > 0 \), \( Z_2 = Z_3 = -1 \). This case corresponds to a dynamical Helium-type of atom. Applications to the study of atoms in high magnetic field and to trions on carbon nanotube will be briefly reviewed. Despite the physical jargon, this will be a genuine mathematical seminar in spectral theory. This is the result of a collaboration with H. Cornean and B. Ricaud.