# Systematics of the $\alpha$ Decaying States of $^{12}$C

**D.V. Fedorov[1], A.S. Jensen[1], and H.O.U. Fynbo[2]**
[1]*IFA, Aarhus University, 8000 Aarhus C, Denmark*
[2]*ISOLDE, EP division , CERN , CH-1213 Geneva , Switzerland*

Several low lying states of $^{12}$C nucleus have only one non-electro-magnetic decay channel – into three $\alpha$ particles. Experimentally the widths of these states differ by five orders of magnitude and the energy distributions of the decay products exhibit very peculiar behaviour.

The widths and the energy distributions are largely determined by the properties of the wave-function at relatively large distances where the three $\alpha$-clusters already are formed. The three-cluster model must therefore be appropriate for a description of the large distance properties of these states, notably the widths.

In this contribution we attempt to consistently describe these $\alpha$ decaying states of $^{12}$C ($0^+$, $1^+$, $1^-$, $2^+$, $2^-$, $3^-$, and $4^+$) within the three-$\alpha$ cluster model. We solve the Faddeev equations where we include short-range and Coulomb potentials between the $\alpha$-particles and also a parametrized three-body potential. The decisive effective barriers are related to the hyper-spherical quantum numbers which are intricately connected with the symmetry and the spin-parity of the states.

We calculate the widths as well as different angular and energy distributions of the $\alpha$-particles from the their decay and compare, where available, with experimental data.