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Density Functional Approach to Finite Many-Body Systems

Nuclear Structure

Nuclear structure is studied with the variation after projection (VAP) approach using nuclear (Skyrme) energy functional in the three-dimensional (3D) real space. Calculated density distribution and excitation spectra for ^{12}C are shown in Fig. 1. The calculation indicates the 3α clustering (triangle and linear-chain) structures for ground and excited states.

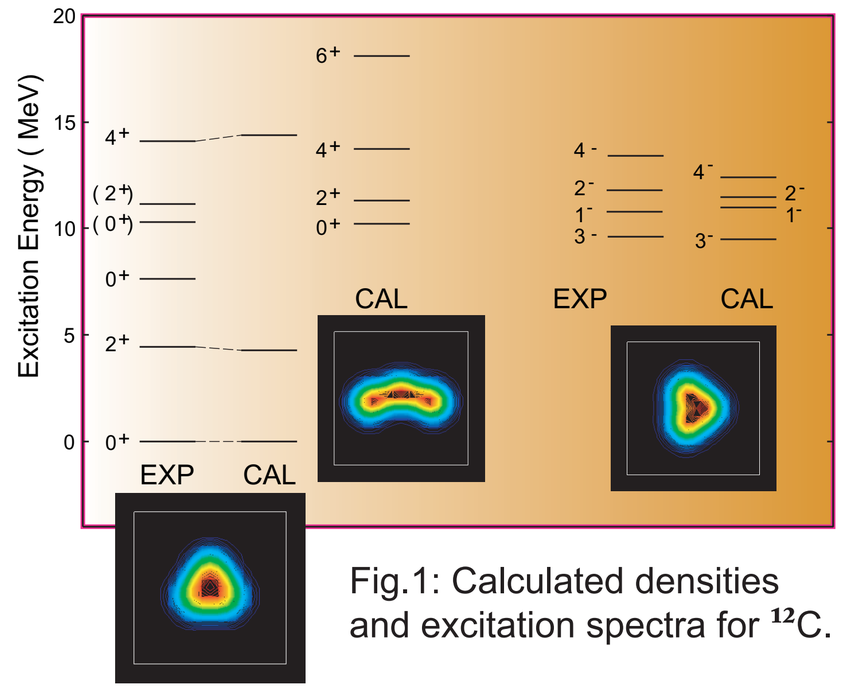
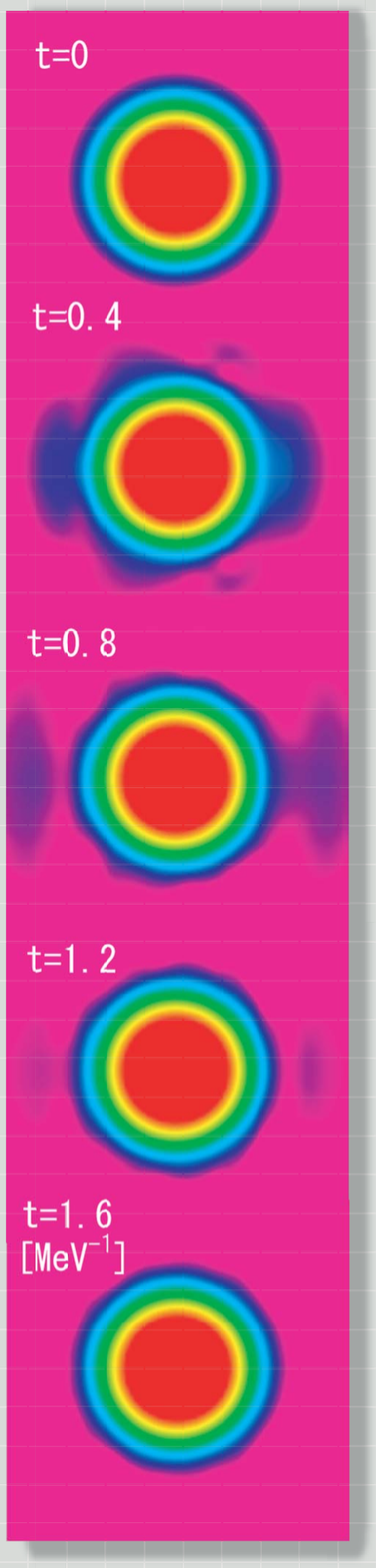


Fig.1: Calculated densities and excitation spectra for ^{12}C.

Nuclear Dynamics



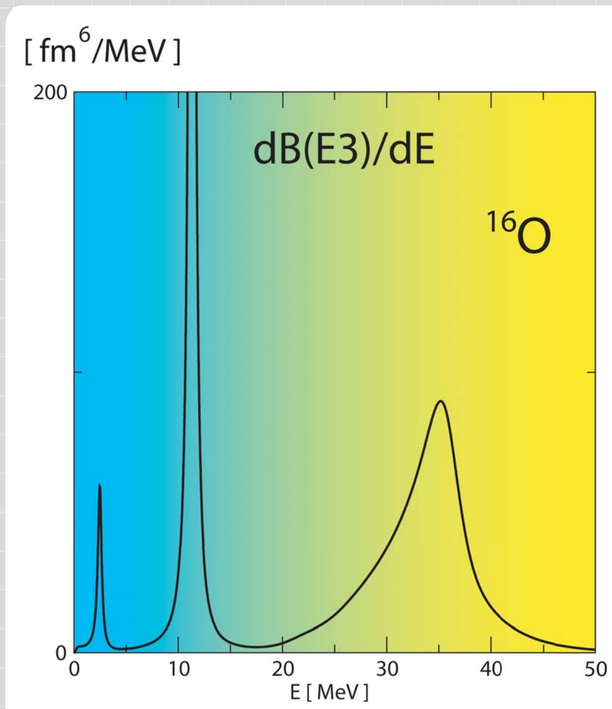


Fig.2: Octupole resonance in the ^{16}O nucleus.

Time-dependent nuclear dynamics is studied with the time-dependent ensity functional theory TDDFT). Density oscillation for isoscalar octupole resonance in ^{16}O is shown in the left panel. The strength function in Fig. 2 is obtained using the Fourier transform technique.

Electronic Dynamics

Quantum optical response is calculated with the TDDFT. The electronic continuum is exactly treated with the reen's function method. The alculation takes account of the dynamical screening, shape and Feshbach resonances, and autoionization. Figure 3 shows calculated photoabsorption in ethylene molecules.

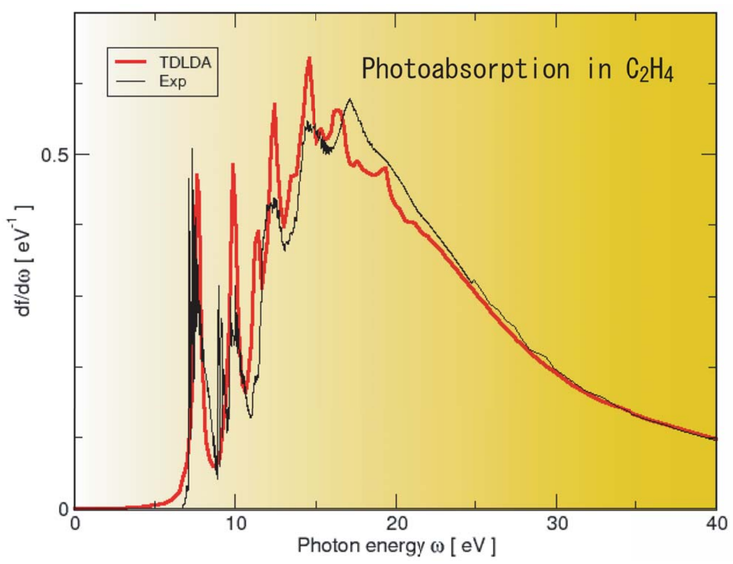


Fig.3: Calculated oscillator strength in ethylene.