Contribution ID: **26** Type: **not specified**

Dynamical correlations in nuclear spectra

Nuclear correlations caused by coupling between single-particle and collective degrees of freedom are discussed. It is shown how the nucleon self-energy containing temporal and spatial non-localities provides fragmentation of the quasiparticle states, compared to the mean-field picture. The nucleon-nucleon effective interaction, derived from this self-energy, acquires an energy dependence which causes the fragmentation of collective modes of excitation like giant resonances and soft modes, compared to the random phase approximation. The "time blocking" approximation to the Bethe-Salpeter equation with singular kernels allows a very elegant treatment of the energy-dependent effective interaction including terms with "backward-going" diagrams and opens a way for inclusion of correlations of growing complexity. Comparison of the calculated strength functions to spectral data allows identification of the nature and mechanisms of formation of various collective and non-collective excited states in nuclei.

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