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Properties of the first 1/2$^+$ state in ^{9}Be from electron scattering and astrophysical implications

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The low-energy level structure of the ^{9}Be nucleus has long been a matter of interest, in particular with respect to the strength of three-body $\alpha + \alpha + n$ cluster configurations. This nucleus has the lowest neutron threshold (S_n = 1.6654 MeV) of all stable nuclei. Already the first excited J$^\pi$ = $1/2^+$ state lies at an excitation energy of several tens of keV above the ^{8}Be + n threshold. Parameters of this resonance are of great astrophysical importance. Due to its closeness to the neutron threshold the resonance has a strongly asymmetric line shape but despite a large number of different experiments there still exist discrepancies between the various deduced resonance parameters [1]. We present high-resolution inelastic electron scattering experiments on ^{9}Be performed at the S-DALINAC. The resonance parameters of the first excited $1/2^+$ state in ^{9}Be are derived in a one-level R-matrix approximation from the present and our older (e, e') data [2]. The astrophysical relevant ^{9}Be(γ, n) cross sections are extracted and discussed. It is very interesting to investigate also the structure of this state. The longitudinal form factor is compared to large-scale no-core shell model (NCSM) calculations. The $B(E1)$ strength for the transition to the $1/2^+$ state extracted from the longitudinal form factor is a factor of two smaller the value extracted from real photon scattering experiments indicating a violation of Siegert's theorem.

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