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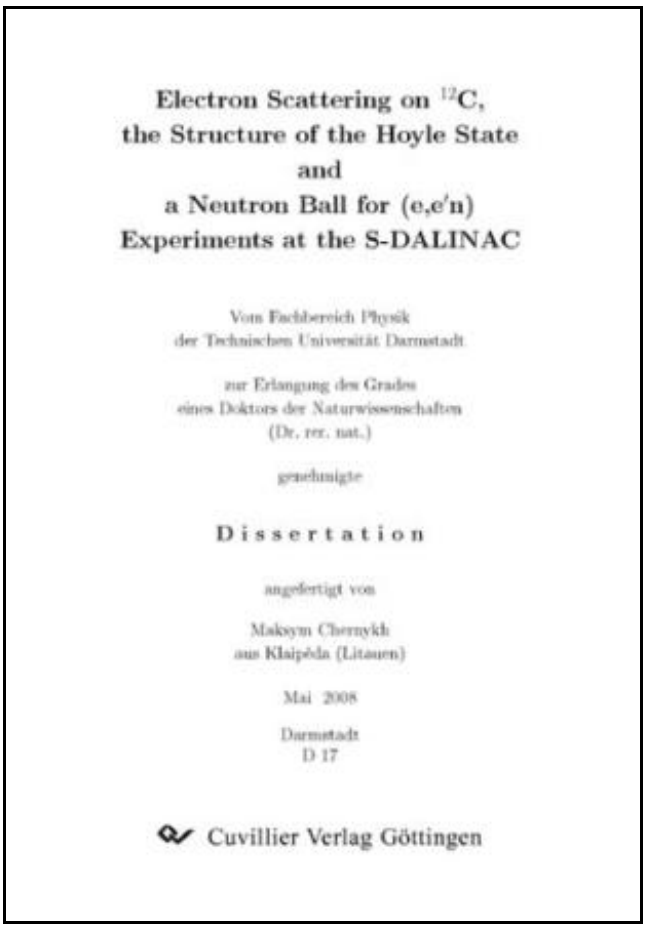
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Vom Fachbereich Physik
der Technischen Universität Darmstadt

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(Dorothy Daugherty)

ELECTRON SCATTERING ON 12C, THE STRUCTURE OF THE HOYLE STATE AND A NEUTRON BALL FOR (E,E[1]N) EXPERIMENTS AT THE S-DALINAC

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Cuvillier Verlag Aug 2008, 2008. Taschenbuch. Book Condition: Neu. 211x144x10 mm. Neuware - The present thesis consists of two parts. Part I is devoted to the study of the second Jpi = 0+ state (Hoyle state) in 12C. Part II deals with the construction of a neutron detector ball for the electron scattering coincidence experiments. The monopole matrix element for the transition from the ground state to the Hoyle state in 12C through internal pair production is an important quantity for calculation of the 3a reaction rate in supernova nucleosynthesis. Therefore, a new value for the monopole matrix element has been extracted using the high-precision electron scattering data. The 12C(e,e') experiment was carried out at the Lintott spectrometer at the S-DALINAC with beam energies between 29.3 MeV and 78.3 MeV and scattering angles between 69 and 141, corresponding to momentum transfers q = 0.2 - 0.7 fm-1. An energy resolution aE 28 keV (FWHM) was achieved. A pair width T pi = 62.2(10) x 10-6 eV was extracted combining a model-independent analysis of the data in the measured momentum transfer range based on plane-wave Born approximation as well as a Fourier-Bessel analysis covering a large momentum transfer range up to 3.1 fm-1. Furthermore, the intrinsic structure of the Hoyle state was investigated by comparison of the elastic electron scattering and transition form factor data with predictions of three different nuclear models. The data clearly indicate a dilute density with a large spatial extension of the Hoyle state in comparison to the ground state. The structure of the Hoyle state has been predicted to be a dilute self-bound gas of a particles, similar to a Bose-Einstein condensate. A closer inspection of the model predictions, which reproduce the experimental findings, contradicts to a naive interpretation of the Hoyle state as a true...

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