Splitting of the Pygmy Dipole Resonance

J. Endres[1], A. Zilges[1], N. Pietralla[2], V.Yu. Ponomarev[2], D. Savran[2], K. Sonnabend[2], M.N. Harakeh[3,4], E. Litvinova[3,5,6], V.I. Stoica[4], H.J. Wörtche[4,7], L. Popescu[8], P. Butler[9], R.-D. Herzberg[9], M. Scheck[9], S. Harissopulos[10], A. Lagoyannis[10], R. Krücken[11], P. Ring[11]

[1] Institut für Kernphysik, Universität zu Köln, Zülpicher Straße 77, D-50937 Köln, Germany

[2] Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, D-64289 Darmstadt, Germany

[3] GSI Helmholtzzentrum für Schwerionenforschung, D-64291 Darmstadt, Germany

[4] Kernfysisch Versneller Instituut, University of Groningen, 9747 AA Groningen, The Netherlands

[5] Frankfurt Institute for Advanced Studies, Universität Frankfurt, D-60438 Frankfurt am Main, Germany

[6] Institute of Physics and Power Engineering, RU-249033 Obninsk, Russia

[7] INCAS[3], Dr. Nassaulaan 9, 9401 HJ Assen, The Netherlands

[8] Belgian Nuclear Research Centre SCK*CEN, Boeretang 200, B-2400 Mol, Belgium

[9] Oliver Lodge Laboratory, University of Liverpool, L69 7ZE, United Kingdom

[10] Institute of Nuclear Physics, N.C.S.R. Demokritos Athens, GR-15310 Athens, Greece

[11] Physik Department, TU München, D-85748 Garching, Germany

In recent years investigations have been made to study the electric Pygmy Dipole Resonance (PDR) systematically, mainly in semi-magic nuclei. For this purpose the well understood high resolution (γ,γ') photon scattering method is used [1]. In $(\alpha,\alpha'\gamma)$ coincidence experiments at $E_\alpha = 136$ MeV a similar energy resolution and a high selectivity to $E1$ transitions can be obtained at the Big-Bite Spectrometer (BBS) at KVI, Groningen. In comparison to the (γ,γ') method a structural splitting of the PDR could be observed in the N=82 nuclei ^{138}Ba and ^{140}Ce and in the Z=50 isotope ^{124}Sn [2,3,4]. There is a low energy part which could be excited in (γ,γ') as well as in $(\alpha,\alpha'\gamma)$ and there is a high energy part which could only be observed in (γ,γ'). The experimental results and theoretical QPM and RQTBA calculations on ^{124}Sn will be presented which are able to reproduce the splitting of the PDR. The low-lying group of $J^\pi = 1^-$ states seem to represent the more isoscalar neutron-skin oscillation of the PDR while the energetically higher lying states seemingly belong to the tail of the isovector Giant Dipole Resonance (GDR).

* This work is supported by the DFG (ZI 510/4-1 and SFB 634), by the LOEWE program of the State of Hesse (HIC for FAIR), the DFG cluster of excellence Origin and Structure of the Universe, and by the EU under EURONS Contract No. RII3-CT-2005-506065.

[1] D. Savran *et al.*, Phys. Rev. Lett. **100**, 232501 (2008).
[2] D. Savran *et al.*, Phys. Rev. Lett. **97**, 172502 (2006).
[3] J. Endres *et al.*, Phys. Rev. C. **80**, 034302 (2009).
[4] J. Endres *et al.*, submitted to Phys. Rev. Lett.