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Baryonium, a common ground for atomic and high energy physics

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Baryonium understood here as a nucleon-antinucleon quasi-bound state was searched for at CERN in the days of LEAR. Nothing has been found, but broad states or states close to the threshold were not excluded. A convincing detection requires selective experiments. Such experiments offering more than scattering or crude absorption have been performed in recent years. These are of two kinds
(1) decays J/ψ -> proton, antiproton, meson (or photon) [1]
J/ψ -> several π mesons
(2) level widths in the lightest antiprotonic atoms
"cold capture" in some heavy antiprotonic atoms, [2]

The selectivity in reactions (1) is due to definite initial state and CP invariance, the selectivity in reactions (2) may be obtained with fine structure resolution, so far available only in the H atom. Both decays (1) indicate existence of a broad S-wave, I= 0 structure which may be interpreted, at least on the basis of Paris N-N-bar potential, as a 50 MeV broad bound state denoted X(1835) by BES. Atomic X-ray experiments give some support for the effect of such state and indicate another 5 MeV wide P-wave quasi-bound state. Both these states find support in the Paris potential.

This talk will review the data and concentrate on a model for decays (1), its applicability to the search of baryonium in few-N systems and formation of J/ψ in nuclei.
There is a similarity in the search of baryonium with antiprotonic atoms and studies of Λ(1405) in K mesic atoms. I will try to discuss relations and possibilities.

[1] J.Z.Bai for BES Collaboration. Phys.Rev.Lett. 91(2003) 02200.
M. Ablikim for BES Collaboration, Phys.Rev.Lett. 95 (2005) 262001.
J-P. Dedonder et al , Phys.Rev. C 80 (2009)0145207
[2] A. Trzcinska et al, Nucl. Phys. A 692

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