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SPECTROSCOPY OF NEUTRON-RICH PALLADIUM AND CADMIUM ISOSTOPES NEAR A = 120*

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New high-spin levels have been identified in the nucleus ^{120}Pd from analysis of the coincidence gamma rays observed in the ^{238}U(α, $f\gamma\gamma\gamma$) reaction. Recoiling fragments were detected with the Rochester heavy-ion detector array, CHICO, in coincidence with gamma-rays using Gammasphere. An A=110-130 mass-gated $\gamma - \gamma - \gamma$ cube from this experiment was constructed and analyzed for coincident gamma-rays in several nuclei near A=120. New results for neutron-rich ^{118}Pd and ^{120}Pd have been obtained. The ^{120}Pd level scheme was extended to spin of 10^+ by building on the new low-energy gamma rays identified in decay studies of ^{120}Rh. The details of the ^{118}Pd level scheme derived from this work are compared to previous work. The systematics of the yrast levels in even-even Pd and Cd isotopes are presented and the symmetry of energy levels around $N = 68$ is discussed. A new 10^+ level in ^{124}Cd has been observed. The population intensity of even-even neutron-rich Cd isotopes is deduced, indicating that nuclides near ^{120}Cd are preferentially populated following alpha-induced fission of ^{238}U.

1. Introduction

The ability to determine high-spin structure from nuclei populated only weakly in nuclear reactions has been significantly improved through use of gamma rays identified in beta decay to set gates on data from triples collected in Gammasphere experiments. In this paper, new critical results are reported for the level structure of ^{120}Pd and ^{124}Cd.

2. Results

The full results are described in a recent paper by Stoyer et al. [1] The main gamma rays needed for setting the initial gates were identified by Walters et al. from the beta decay of ^{120}Rh. [2] The structure of ^{120}Pd revealed a remarkable symmetry for the nuclear structure of he neutron-rich Pd nuclei centered at ^{114}Pd, as shown in Figure 1. Moreover, the results were consistent the level structure expected from a decade-old IBM-2 calculation. [3]

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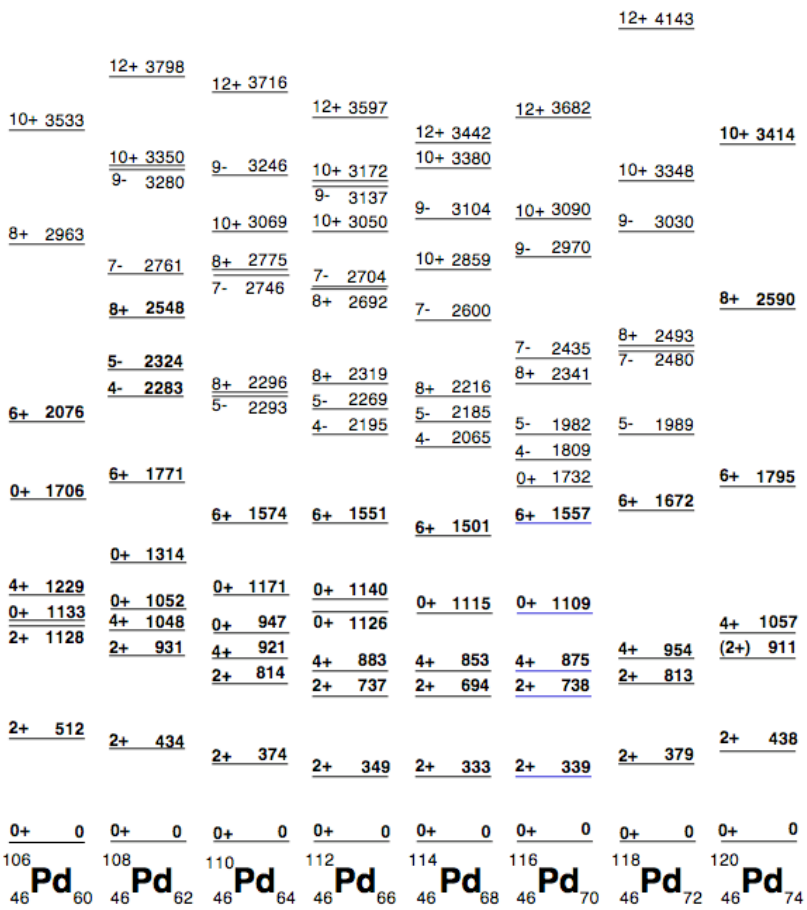

Figure 1. Levels of even-even neutron-rich Pd isotopes.

The new structure for ^{124}Cd also proved consistent with the trends established in the lighter even-even Cd isotopes as can be seen in Figure 2. What is observed is a lowering of the energies of the negative-parity levels and the 2-particle 8^+ and 10^+ levels as the number of neutron is increased. Those trends can be contrasted with the rise in the positions of the 2^+ and 4^+ levels. These levels are of considerable importance as they provide a reference for the determination of the structures of the levels in heavier ^{126,128}Cd nuclei that are identified in the decay of microsecond isomers in these nuclei. [4]

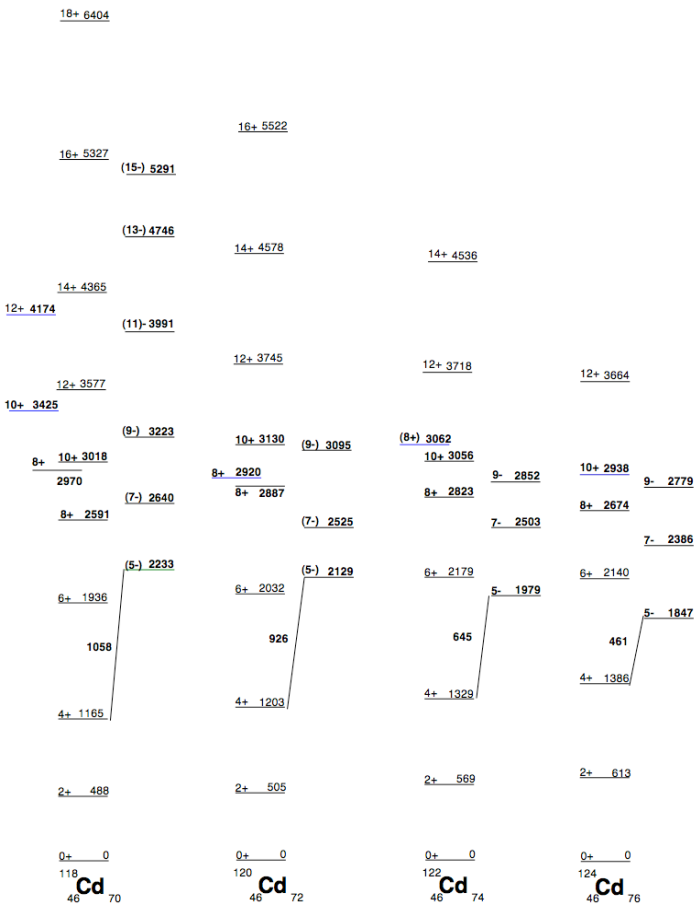

Figure 2. Levels of neutron-rich even-even Cd nuclei.

References

1. M. A. Stoyer et al., Nuclear Physics A **787**, 455 (2007).

2. W. B. Walters et al., Physical Review C **70**, 034314 (2004).

3. K.-H. Kim et al., Nuclear Physics **A604**, 163 (1996).

4. N. Hoteling et al., Physical Review C **76**, 044324 (2007).