The new observation of S=-2 Heavy H^+ Stable dibaryon

P.Z. Aslanyan , B.A. Shahbazian , T.A. Volokhovskaya,V.N.Yemelyanenko, A.S. Martynov, V.S.Rikhvitzkiy

Joint Institute for Nuclear Research, Dubna, Moscow Region 141980, Russia

We have observed else two positively charged events which were interpreted as S=-2 positively charged H^+ heavy stable dibaryons.

New particles or states of matter containing 2 or more strange quarks have inspired many experiments and much theoretical speculation. Simple considerations of symmetry and the properties of the color-magnetic interaction argue for increased binding in three flavor matter - system containing u,d and s quarks(true Hundy). These objects known a H particles (uuddss), strangulates, and strange matter and are predicted to be stable in many calculations. Heavy isotriplet stable dibaryon H (I=1, J=0+, Y=0, B=2, S=-2) a mass 2370 MeV/c^2 predicted by the Callan-Klebanov-Kunz-Mulders[5-9].

The reliable identification of the above events needs for multivertex kinematical analysis which in turn is feasible only using 4pi- detectors and high measurement precisians of the sought for objects. The best suited for these purpose is the 2 m propane bubble chamber.

The identification of events was performed using the methods, well - known in bubble chamber work. The dibaryons were identified via a multivertex kinematical analysis using the CERN program Grind as well as all methods of particle identification afforded by the PBC technique.

1.Several events detected on photographs of the JINR 2m propane bubble chamber exposed to 10GeV/c proton beam, were interpreted a heavy neutral and positive charge H stable dibaryons[1-4](Table 1).

2.The candidates for H^+ dibaryons were searched for in sample of the so called one-positive-prong secondary events. In this events the Λ^0 -hyperons point to vertices of one-positive-prong stars, created by positive particles, emitted from the parent interactions of the primary

10 GeV/c protons in propane. The first event detected in this sample is formed by a beam proton, producing a five prong star. The appearance of its first part, 21.85 cm long and realitive ionazation I/$I_0 \approx 1.8$, situated between the star and kink -vertices, suggests that it is due to a relativistic, heavily ionizing positively charged massive particle than proton. The second part is certainly due to a slow proton, $P_p = 252.9 MeV/c^2$, which stops in propane. A slow V^0-particle is clearly seen near star. Note, that on this photograph there are no interactions seen, which could serve as potential V^0 emission vertices. The decay particles track are a proton $P_p = 768.7 \pm 11.6 MeV/c^2$ and a slow negative pion with $P_\pi^- = 196.1 \pm 25.0 MeV/c^2$. Thus the V^0 can be due to the weak decay of a Λ^0 hyperon only. Indeed, the invariant mass of the (p, π^-) pair is $1115.5 \pm 1.4 MeV/c^2$. The hypothesis on emission of this hyperon from primary interaction fails to the fit event with $\chi^2 = 967$. This negative result is due to a large noncomlanarity angle $\eta = 0.4718 rad.$. Contrary to this, the hypothesis on emission of the Λ-hyperon from the kink vertex fits well the event with χ^2(1V-3C) = 1.2, CL=$75^o/_o, P_{\Lambda^0}$ =$964 \pm 87 MeV/c \Delta p^\perp = 37 \pm 34 MeV/c, \eta = 0.136 rad.$)
.

The hypothesis on the inclusive three body weak decay $H^+ \to p + \pi^0 + \Lambda^0$, $\Lambda \to p + \pi^-$ fitts the event with $\chi^2(2V-3C) = 2.3, CL = 89^o/_o, M_{H^+} = 2534 \pm 75 MeV/c^2$.

There were no sucsessful (2V-4C)fits for the reaction sequences Table 2.

3.The search other candidates, excepting the event, have been tried for the weak decay hypothesis $H^+ \to p + \Lambda^0$, $\Lambda \to p + \pi^-$ and $H^+ \to p + \pi^0 + \Lambda^0, \Lambda \to p + \pi^-$. If either of them or both hypothesese fitted an event, the hypotheses on the possible imitating reactions (table 2) have been tried.

Only one event with $I/I_0 \approx 6$ relative ionization from all candidates events was successfully fitted by only weak decay hypothesis, $H^+ \to p + \pi^0 + \Lambda^0, \Lambda \to p + \pi^-$ and there are not imitating reactions (table 2). Note that the (1V-1C) weak decay hypothesis $Y^0 \to M^0 + \Lambda^0 or \gamma + \Lambda^0$ failed to fit the event. The inclusive weak decay hypothesis $H^+ \to p + \pi^0 + \Lambda^0, \Lambda \to p + \pi^-$ fits the event with $\chi^2(2V-4C)$=3.29, CL=$51.1^o/_o, P_{\Lambda^0} = 476.9 \pm 9.2 MeV/c, M_{H^+} =$

$2400.5 \pm 4.92 MeV/c^2$. The Λ^0 - hyperon points only to H^+ decay vertex. Unfortunately the vertex of parent primary interaction is not seen on this photograth.

We are very indepted to our collegues at the collaborating institutions for their assistance data procesing and for fruitful discussions.

References

[1] B.A. Shahbazian et al.,Phys. Lett. B316(1993)593.

[2] B.A. Shahbazian et al., JINR Rapid Commun.54,No.3(1992)38.

[3] B.A. Shahbazian et al., JINR Rapid Commun.54,No.3(1992)51.

[4] P.Z. Aslanyan, B.A.Shahbazian et al., Int. Workshop WIN'97,Italy. JINR Rapid Commun.,No. 1(87)-98.

[5] P.J.G. Mulders, A.T. Aerts, J.J. de Swart, Phys.Rev D21(1980)2553.

[6] A.E. Dorokhov, Yu.A. Zubov, N.I. Kochelev, Particles and Nuclei, vol.23, part 5, p.1992, Dubna.

[7] I.R. Klebanov and K.M. Westerberg PUPT-1555, hep-ph/9508279.

[8] J.L.Rosner, Phys. Rev, D,33(1986)2043.

[9] C.B. Dover, Nuovo Cimento 102A(1989)521.

Table 1.

No	Channel of decay	Mass(MeV/c^2 H^{0+} Dibaryon	Results 2-vertex fits (C.L. °/∘)
1	$H^0 \to \Sigma^- p, \Sigma^- \to n\pi^-$(pub.)	2409±11	22. (1V-1C)fits
2	$H^0 \to \Sigma^- p, \Sigma^- \to n\pi^-$(pub.)	2385±31	34. (4V-4C)fits
3	$H^+ \to p\pi^0\Lambda^0, \Lambda^0 \to p\pi^-$(pub.)	2376±9	87.(2V-3C)fits
4	$H^+ \to p\Lambda^0, \Lambda^0 \to p\pi^-$(pub.)	2409±13	17. (2V-5C)fits
5	$H^+ \to p\pi^0\Lambda^0, \Lambda^0 \to p\pi^-$(new)	2534±75	89. (2V-6C)fits
6	$H^+ \to p\pi^0\Lambda^0, \Lambda^0 \to p\pi^-$(new)	2401±5	51. (2V-4C)fits

Table.2

No	Preocessis	Number of reaction sequenses	Result of fits
1	p+n	$\to pK^0\Lambda^0, \Lambda^0 \to p\pi^-$	no (2V-4C)fits
2		$\to pK^{*0}\Lambda, \Lambda \to p\pi^-$	
3	Σ^++n	$\to p\Lambda, \Lambda \to p\pi^-$	no (2V-6C)fits
4		$\to p\pi^0\Lambda, \Lambda \to p\pi^-$	no (2V-4C)fits
5		$\to pM^0\Lambda, \Lambda \to p\pi^-$	