ADDENDUM #4 TO P11

The Omega Particles, ($J = 1/2\hbar$)

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Abstract.

This Addendum provides details of the energy distribution of the quarks that make up all Omega sub-atomic particles with an intrinsic angular momentum of $J = 1/2\hbar$. Also discussed are the anomalies/questions that have arisen from earlier investigations.

This is the fourth Addendum to "Derivation of the Quark Energy Distributions and Decay Products of Baryonic Sub-Atomic Particles".

Contents

1.0 Introduction.

There are eight Omega particles with $J = 1/2\hbar$ as shown in the following brief table with their quark complement.

Particle	Quarks
Ω_{c}^{0}	ssc
Ω_{cc}^{+}	scc
Ω_{b}^{-}	ssb
Ω_{cb}^{0}	scb
$\Omega_{cb}^{0/}$	scb
Ω_{ccb}^{+}	ccb
Ω_{bb}^{-}	sbb
Ω_{cbb}^{0}	cbb

Table 1.1 - The Omega particles.

Of the above, the decay products of Ω_{cc}^{+}, Ω_{cb}^{0}, $\Omega_{cb}^{0/}$, Ω_{ccb}^{+}, Ω_{bb}^{-}, and Ω_{cbb}^{0} are reported in [1] and [2] as unknown. However, as it contains the same quark compliment, it is proposed that $\Omega_{cb}^{0/}$ is a high confinement energy version of its unprimed counterpart and, as a consequence, the decay of the former to the latter will take place without a quark flavour change, in an identical manner to that shown in [4], [5] and [6], (Decay Type 8).

Of the two particles for which the decay products have been identified in [1] and [2], Ω_{c}^{0} and Ω_{b}^{-}, there are a total of five decay paths reported. These include a total of three decay types all of which are variably exhibited by by the Nucleon, Lambda, Sigma and Xi particles discussed in [3], [4], [5] and [6]. Consequently, the Intrinsic Angular Momentum details and Quark Energy Distribution details have, in the interests of conciseness, been relegated to Appendix A in favour of a review of anomalies/questions that have been identified to date in [3], [4], [5] and [6].

Note that as in [3], [4], [5] and [6], only particles with $J = 1/2\hbar$ containing quarks with $J = \pm 1/2\hbar$ are considered in this Addendum.

Also note that energy will be represented as equivalent mass via the units MeV/c^2, which for conciseness will be assumed and therefore omitted in the text.

For a full appreciation of this Addendum it is recommended that [3] be read first.

2.0 Nomenclature.

In this Addendum the following nomenclature will be used.

P Indicates any Baryon.
P(#) Indicates the type of Intrinsic Angular Momentum of P.

$q_\#$ Indicates the #th quark of P.
E_c Indicates confinement energy.
E_k Indicates kinetic energy.
$\rightarrow$ Indicates a particle decay.
$\Rightarrow$ Indicates a quark flavour change.

3.0 Intial Discussions

3.1 Decay Distribution Patterns - Overall Summary.

For the two Omega Particles for which they are known, this summary lists their primary decay products according to their Intrinsic Angular Momentum configurations. Included, where known, are their branching fractions from [2].

P(1)	P(2)	P(3)	% Branching Fraction.
$\Omega^0_c(1)$	$\Omega^0_c(2)$		
$\Sigma^+(1)$	$\Sigma^+(2)$		Seen
$\Omega^-(1)$	$\Omega^-(2)$		
$\Xi^0(1)$	$\Xi^0(2)$		
$\Xi^-(1)$	$\Xi^-(2)$		
$\Omega_b^-(1)$	$\Omega_b^-(2)$		
$\Omega^-(1)$	$\Omega^-(2)$		100

Table 3.1 - Overall Summary of Decay Configuration Patterns.

3.2 Decay Types.

The types of decay exhibited by all Omega particles in Table 3.1 is shown in the table below. These types arise according to, in their Interim Energy Distributions tables, the nature of the quark flavour changes, and how the quark confinement energy varies.

Particle Decay	Decay Type	Interim Energy Distribution - Confinement Energy Sign			Quark Flavour Change	
		q_1	q_2	q_3	Down	Up
$\Omega^0_c \rightarrow \Sigma^+$	12	+ve	+ve	+ve	q_2, q_3	
$\rightarrow \Omega^-$	15	+ve	+ve	+ve (J=3/2$\hbar$)	q_3	
$\rightarrow \Xi^0$	1	+ve	+ve	+ve	q_3	
$\rightarrow \Xi^-$	1	+ve	+ve	+ve	q_3	
$\Omega_b^- \rightarrow \Omega^-$	15	+ve	+ve	+ve (J=3/2$\hbar$)	q_3	

Table 3.2 - Types of Decay Exhibited by Omega Particles.

For specifics of their Intrinsic Angular Momentum configurations etc, see Appendix A.

4.0 Summary Discussion on $J = 1/2\hbar$ Baryonic Particle Decay Anomalies.

Because the types of decay of the Omega particles in Tables 3.1 and 3.2 are identical to those of particles discussed in [3], [4], [5] and [6], their Intrinsic Angular Momentum and Quark Energy Distributions characteristics have been relegated to Appendix A. This section is therefore devoted to a summary review on the decay anomalies/questions that have arisen for all $J = 1/2\hbar$ Baryons as detailed in [3], [4], [5] and [6].

4.1 Listing of Anomalies/Questions Determined to Date.

(i) General Anomalies/Questions Applicable to All Particles.

(a) How a particle decay is initially triggered.
(b) The mechanism behind multiple decay paths.
(c) In double quark flavour change decays, are these simultaneous or consecutive.
(d) In double quark flavour change decays, if these are consecutive, what triggers the second change.
(e) The non-appearance of apparently permissible decays.
(f) The nature of quark confinement energy.
(g) The mechanism behind charge variation during quark flavour change.
(h) The source of intrinsic angular momentum if not spin.

(ii) Anomalies Determined in P11.

(i) The long decay time of $n^0 \rightarrow p^+$.

(iii) Anomalies Determined in P11 Addendum #1 - Lambda.

(j) The cause of quark flavour changes "up", i.e. $u \Rightarrow d$.
(k) The mechanism behind double quark flavour changes.
(l) Theoretical determination of branching fractions.

(iv) Anomalies Determined in P11 Addendum #2 - Sigma.

(m) The mechanism behind the flavour change of the second highest energy quark instead of the highest.
(n) The triggering mechanism of decay types 1ϕ, 2ϕ, 7, 9 and 10.

(v) Anomalies Determined in P11 Addendum #3 - Xi.

No apparent anomalies other than those above.

(v) Anomalies Determined in P11 Addendum #4 - Omega.

No apparent anomalies other than those above.

4.2 Potential Resolution of Anomalies/Questions Determined to Date.

It is not proposed/possible to resolve the anomalies listed above in this Addendum, because the remaining four Addendums to P11 to be completed may provide further information which will assist in that task. However, what can be included here is an indication of the investigations that have/will be carried out that will/may provide resolutions to some.

(i) Anomaly 4.1(i)(a)	This will be discussed in detail in the final Addendum to P11, (P11 Addendum #8).
(ii) Anomalies 4.1(i)(b),(c),(d) 4.1(iii)(j),(k) 4.1(iv)(m),(n)	These will be discussed in detail when Interim Energy Distributions are more fully investigated.
(iii) Anomaly 4.1(ii)(i)	This will discussed when energy flow paths are investigated.

(iv) Anomalies 4.1(i)(e),(f),(g),(h) No resolution of these anomalies is at present clear.
4.1(iii)(l)

5.0 Conclusions.

With regard to the decay features of the Omega particles, there is nothing specific that warrants discussion as all decay types exhibited by them have already been covered in [3], [4], [5] and [6].

Of the 14 decay anomalies that have been noted to date, it has been suggested that nine may possibly be resolved as a result of further investigation of the decay processes involved in these particles. However, this still leaves five for which there is as yet no indication of how a resolution may be approached. These five anomalies are the most important as they relate to the very basic features of both the existence and decay of Baryonic particles. However, the four Addendums to P11 yet to be completed concerning those particles with intrinsic angular momentum of $J = 3/2\hbar$, may hopefully be useful in indicating additional investigations to be followed in resolving these anomalies.

APPENDIX A.

Particle	**Intrinsic Angular Momentum Configurations.**				**Energy Distributions.**				
Ω^0_c	Ω^0_c(#)	s_1	s_2	c_1	Energy	s_1	s_2	c_1	Total
	1	↑	↓	↑	Matter	100	100	1250	1450
	2	↓	↑	↑	Resonance	17.00	17.00	1.36	35.35
					Confinement	83.44	83.44	1042.84	1209.85
					Total	200.43	200.43	2294.33	2695.20
Ω^+_{cc}	Ω^+_{cc}(#)	s_1	c_2	c_1	Energy	s_1	c_2	c_1	Total
	1	↑	↑	↓	Matter	100	1250	1250	2600
	2	↑	↓	↑	Resonance	36.52	2.92	2.92	42.36
					Confinement	42.69	533.59	533.59	1109.86
					Total	179.2	1786.51	1786.51	3752.22
Ω^-_b	Ω^-_b(#)	s_1	s_2	b_1	Energy	s_1	s_2	b_1	Total
	1	↑	↓	↑	Matter	100	100	4300	4500
	2	↓	↑	↑	Resonance	1.85	1.85	0.04	3.75
					Confinement	34.83	34.83	1497.61	1567.27
					Total	136.68	136.68	5797.66	6071.02
Ω^0_{cb}	Ω^0_{cb}(#)	s_1	c_1	b_1	Energy	s_1	c_1	b_1	Total
	1	↑	↑	↓	Matter	100	1250	4300	5650
	2	↑	↓	↑	Resonance	72.78	5.82	1.69	80.29
	3	↓	↑	↑	Confinement	33.77	422.08	1451.97	1907.82
					Total	206.54	1699.91	5753.66	7638.11
$\Omega^{0/}_{cb}$	$\Omega^{0/}_{cb}$(#)	s_1	c_1	b_1	Energy	s_1	c_1	b_1	Total
	1	↑	↑	↓	Matter	100	1250	4300	5650
	2	↑	↓	↑	Resonance	72.78	5.82	1.69	80.29
	3	↓	↑	↑	Confinement	36.23	452.85	1557.79	2046.87
					Total	209.01	908.67	5859.48	7777.16

Particle	Intrinsic Angular Momentum Configurations.				Energy Distributions.				
Ω^{+}_{ccb}	Ω^{+}_{ccb}(#)	c_1	c_2	b_1	Energy	c_1	c_2	b_1	Total
	1	↑	↑	↓	Matter	1250	1250	4300	6800
	2	↑	↓	↑	Resonance	65.48	65.48	19.04	150.00
					Confinement	484.63	484.63	1667.10	2636.36
					Total	1800.11	1800.11	5986.15	9586.36
Ω^{-}_{bb}	Ω^{-}_{bb}(#)	s_1	b_1	b_2	Energy	s_1	b_1	b_2	Total
	1	↑	↑	↓	Matter	100	4300	4300	8700
	2	↑	↓	↑	Resonance	374.87	8.72	8.72	392.31
					Confinement	52.01	2236.34	2236.34	4524.68
					Total	526.88	6545.05	6545.05	13616.99
Ω^{0}_{cbb}	Ω^{0}_{cbb}(#)	c_1	b_1	b_2	Energy	c_1	b_1	b_2	Total
	1	↑	↑	↓	Matter	1250	4300	4300	9850
	2	↑	↓	↑	Resonance	414.76	120.86	120.86	656.48
					Confinement	781.93	2689.84	2689.84	6161.61
					Total	2447.69	7110.70	7110.70	16668.09

Table A.1 - Intrinsic Angular Momentum Configurations and Energy Distributions of the Omega Particles.

The arrows in Table A.1 represent the direction of Intrinsic Angular Momentum.

As stated in the Introduction the decay products of the majority of the particles in Table A.1 is unknown. For the two that are, their Interim Energy Distributions can be determined from the basic theory in [3]. Their decay products are shown in [1] and/or [2].

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