ELEMENTARY PARTICLE

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ABSTRACT

In this paper we review some elementary particle.They are very important part of standard model.Such as π,K.Mass, Width, Angular momentum, Parity, Isospin are our point.They may interact through the strong electromagnetic weak or through

some unknown force.The purpose of this review is to provide a guide for future searches what is known, what is not known. This is very necessary for the beginner.

1 PARTICLE TREE

There are so many elementary particles, So the best way is classify them.All elementary particles are made up quarks.In this paper we just focus on the meson and baryon which composed of 2 or 3 quarks.

1. Light Unflavored Mesons
2. Strange Mesons
3. N Baryons
4. Δ Baryons
5. Λ Baryons
6. Σ Baryons
7. Ξ Baryons

1.1 Light Unflavored Mesons

What is light unflavored mesons? In the quantum mechanic, we can use some quantum numbers to describe a quantum system.For the elementary particles, we usually use S, C and B. Light unflavored mesons is $S = C = B = 0$.

Table 1: Light Unflavored Mesons

Particle	Mass(MeV)	Width	$I^G(J^{PC})$
$\pi^{\pm}$	139.57018 ± 0.00035	$(2.6033 \pm 0.0005) * 10^{-8}s$	$1^-(0^-)$
π^0	134.9766 ± 0.0006	$(8.52 \pm 0.18) * 10^{-17}s$	$1^-(0^{-+})$
η	547.862 ± 0.017	$1.31 \pm 0.05keV$	$0^+(0^{-+})$
η'	957.78 ± 0.06	$0.197 \pm 0.009MeV$	$0^+(0^{-+})$
ρ	775.26 ± 0.25	$149.1 \pm 0.8MeV$	$1^+(1^{--})$
ω	782.65 ± 0.12	$8.49 \pm 0.08MeV$	$0^-(1^{--})$
ϕ	1019.461 ± 0.019	$4.266 \pm 0.031MeV$	$0^-(1^{--})$

Some particles are not the C eigenstate, such as $\pi^{\pm}$. We also could use lifetime to express the width, because we have $\Gamma = \frac{\hbar}{\tau}$.

1.2 Strange Mesons

Strange mesons are $C = B = 0, S = \pm 1$.

Table 2: Strange Mesons

Particle	Mass(MeV)	Width	$I(J^P)$
$K^{\pm}$	493.667 ± 0.016	$(1.2380 \pm 0.0020) * 10^{-8}s$	$\frac{1}{2}(0^-)$
K^0	497.611 ± 0.013	-	$\frac{1}{2}(0^-)$
$K^{*\pm}$	892.66 ± 0.26	$46.2 \pm 1.3MeV$	$\frac{1}{2}(1^-)$
K^{*0}	895.81 ± 0.19	$47.4 \pm 0.6MeV$	$\frac{1}{2}(1^-)$

Koan is not G and C eigenstate. K^0 is not lifetime eigenstate, but K^0_L and K^0_S is.

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1.3 N Baryons

N baryons are $I = \frac{1}{2}, S = 0$.

Table 3: N Baryons

Particle	Mass(MeV)	Width	$I(J^P)$
p	938.272081 ± 0.000006	$2.1 * 10^{29} years$	$\frac{1}{2}(\frac{1}{2}^-)$
n	939.565413 ± 0.000006	$880.2 \pm 1.0s$	$\frac{1}{2}(\frac{1}{2}^-)$

p and n are not G and C eigenstate.

1.4 Δ Baryons

Δ baryons are $I = \frac{3}{2}, S = 0$.

Table 4: Δ Baryons

Particle	Mass(MeV)	Width	$I(J^P)$
Δ^-	-	-	$\frac{3}{2}(\frac{3}{2}^-)$
Δ^0	-	-	$\frac{1}{2}(\frac{3}{2}^+)$
Δ^+	-	-	$\frac{1}{2}(\frac{3}{2}^+)$
Δ^{++}	-	-	$\frac{3}{2}(\frac{3}{2}^+)$

The pdg only give Breit-Wigner mass(mixed charges) = 1230 to 1234 MeV. And Breit-Wigner width(mixed charges) = 114 to 120 MeV.

1.5 Λ Baryons

Λ baryons are $I = 0, S = -1$.

Table 5: Λ Baryons

Particle	Mass(MeV)	Width	$I(J^P)$
Λ	1115.683 ± 0.006	$(2.632 \pm 0.020) * 10^{-10}s$	$0(\frac{1}{2}^+)$

1.6 Σ Baryons

Σ baryons are $I = 1, S = -1$.

1.7 Ξ Baryons

Ξ baryons are $I = \frac{1}{2}, S = -2$.

1.8 Born in Lab

PION The invariant differential cross sections for inclusive neutral pion at mid-rapidity are measured in proton-proton collisions at $\sqrt{2} = 8TeV$ using the ALICE

Table 6: Σ Baryons

Particle	Mass(MeV)	Width	$I^{(}J^{P})$
Σ^+	1189.37 ± 0.07	$(0.8018 \pm 0.0026) * 10^{-10}$s	$1(\frac{1}{2}^+)$
Σ^0	1192.642 ± 0.024	$(7.4 \pm 0.7) * 10^{-20}$s	$1(\frac{1}{2}^+)$
Σ^-	1197.449 ± 0.030	$(1.479 \pm 0.011) * 10^{-10}$s	$1(\frac{1}{2}^+)$
$\Sigma(1385)^+$	1382.80 ± 0.35	$36.0 \pm 0.7MeV$	$1(\frac{3}{2}^+)$
$\Sigma(1385)^0$	1383.7 ± 1.0	$36 \pm 5MeV$	$1(\frac{3}{2}^+)$
$\Sigma(1385)^-$	1387.2 ± 0.5	$39.4 \pm 2.1MeV$	$1(\frac{3}{2}^+)$

Table 7: Ξ Baryons

Particle	Mass(MeV)	Width	$I(J^P)$
Ξ^0	1314.86 ± 0.20	$(2.90 \pm 0.09) * 10^{-10}$s	$\frac{1}{2}(\frac{1}{2}^+)$
Ξ^-	1321.71 ± 0.07	$(1.639 \pm 0.015) * 10^{-10}$s	$\frac{1}{2}(\frac{1}{2}^+)$
$\Xi(1530)^0$	1531.80 ± 0.32	$9.1 \pm 0.5MeV$	$\frac{1}{2}(\frac{3}{2}^+)$
$\Xi(1530)^-$	1535.0 ± 0.6	$9.9^{+1.7}_{-1.9}MeV$	$\frac{1}{2}(\frac{3}{2}^+)$

detector at LHC. The neutral pion is identified from the invariant mass of photon pairs detected by the PHOS detector covering $260 < \phi < 320$, and $|\eta| < 0.12$[1].

KAON A search for CP and P violation using triple-product asymmetries is performed with $\Lambda_b^0 \to pK^-\pi^+\pi^-$,$\Lambda_b^0 \to pK^-K^+K^-$ and $\Xi_b^0 \to pK^-K^-\pi^+$ decays. The data sample corresponds to integrated luminosities of 1.0fb−1 and $2.0fb^{-1}$, recorded with the LHCb detector at centre-of-mass energies of $7TeV$ and $8TeV$, respectively. The CP- and P-violating asymmetries are measured both integrating over all phase space and in specific phase-space regions. No significant deviation from CP or P symmetry is found.[2]

η MESON We report the first observation of the doubly Cabibbo-suppressed decays $D^+ \to K^+\eta^-$ using a $791fb^{-1}$ data sample collected with the Belle detector at the KEKB asymmetric-energy e^+e^- collider. [3]

ρ MESON [4]

2 DECAY MODEL

2.1 Strong Decay

2.2 Weak Decay

2.3 Electromagnetic Decay

3 PARTICLE IN THE DETECTOR

4 SUMMARY AND DISCUSSION

Reference to Figure 1 on the following page.

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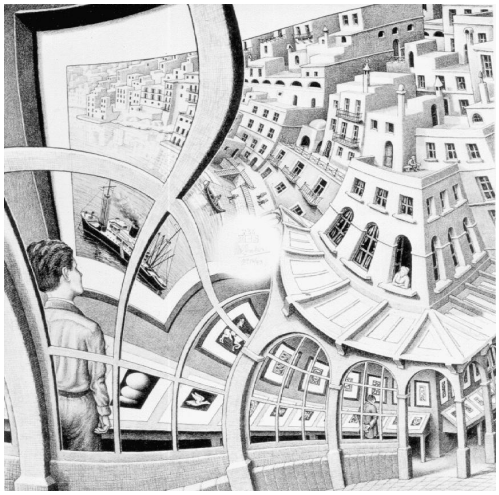

Figure 1: An example of a floating figure (a reproduction from the *Gallery of prints*, M. Escher, from http://www.mcescher.com/).

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4.1 Subsection

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4.1.1 *Subsubsection*

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WORD Definition

CONCEPT Explanation

IDEA Text

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- First item in a list

- Second item in a list
- Third item in a list

4.1.2 *Table*

Table 8: Table of Grades

Name		
First name	Last Name	Grade
John	Doe	7.5
Richard	Miles	2

Reference to Table 8.

4.2 Figure Composed of Subfigures

Reference the figure composed of multiple subfigures as Figure **??** on page ??. Reference one of the subfigures as Figure **??** on page ??.

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