Our Hidden Reality

Revealing the Foundational Structure

Richard L. Marker

“ the book
nobody will read ”

dedicated to

my wife Gini

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Preface

Seeing the *unseeable* lies beyond our reach. Visualizing the *unseeable* lies within our reach. Many consider this impossible. There are good reasons for skepticism. Our physical reality conditions us to expect conformance with it. How could we have the experience or the language to understand or describe our hidden reality? Researchers may try to understand our hidden reality by extending our perceived reality to ever smaller concepts or particles. Some look for hidden dimensions. Finding a solution remains elusive.

Even an open-minded reader will find concepts in this book that run counter to their beliefs. It takes time to digest these thoughts and incorporate them into your world view. You may wonder if the reader needs to be a philosopher or physicist. Philosophers and physicists understand many deeper implications. Contrariwise, they incorporate established views into their thinking.

Our journey assumes that a structure underlies space, and that the electron forms an integral part of the structure. The building blocks for the structure are neighboring space-like elements that all behave the same. These building blocks lack any physical characteristics. At the foundational level there are no physical characteristics. There is no concept of time, distance, or geometry. Our task requires building a universe from this simple beginning.

The building blocks behave 100% causally mechanistically. The resulting structure requires the phase difference between adjacent elements to shift by some fraction of a full circle. The fractional (i.e. rational) requirement leads to quantum packet interactions. Early on we find the electron needs self-entanglement (a single particle entangled with itself) and spin. The structure of the electron helps us to understand its dual wave-particle nature.

This book contains the details of Kant's noumena, that which is (almost) unknowable. Conjecture provides the only path to understanding noumena. Explanations of noumena challenge the reader to explore thoughts that fall far from physical reality.

Nature provides a relationship that moves all of this conjecture into something closer to fact. The details appear in Appendix II. The *proof* in Appendix II assumes the reader has understandings that few would have. Details of the baryon quantum numbers in chapter 7 provide a more direct illustration of the power of the theory. This is especially true for the fractional quark charge.

Edition two keeps the edition one page numbering. Changes in this edition are mostly cosmetic, grammar, or spelling. Notable exceptions include: correcting the movement description for Figure **??**: Spin Details (page **??**); expanding explanation of baryon quantum numbers (pages 23-24); and replacing the description for Section 7.6, Gell-Mann – Nishijima formula (page 26). Except for the Figure **??** details and Section 7.6, previous content has been enhanced (as opposed to corrected).

The meaning of *charge* has been clarified in the final paragraph in Section **??**, The electron (page **??**).

Part III
Baryonic Matter

Chapter 7
Baryons

Part III may be skipped without loss of continuity. For DCT to be a useful model of the foundational structure it must be capable of structurally representing baryons. The structure needs to yield quantum numbers and an understanding of particle decay paths.

The structures shown for baryonic matter and decay paths are considered illustrative, rather than definitive. It is important that baryonic matter can be reasonably represented in DCT. For proof of concept, we consider particles in the major baryon octet.

7.1 Triangles

What is a triangle and why do we use them? You may recall that chain segment connecting ends align or counter align their phases. This provides a 'common denominator' for connections. Non-aligned phases in the connecting ends make building a structure much more challenging. It would be like building a physical structure with random sized corner angles.

Other reasons for using triangles include phase symmetry and the need for three connections at vertices. Three connections result from the need for connections to change from one chain link to another. A single 'side' connection can move as a single event. Multiple 'side' connections cannot. Take note that the 120° phase difference between connections does not conflict with the 180° angle sums for triangles. No geometry exists at the foundational reality level. This is not a geometric triangle.

How do triangles connect with the structure of space? They connect with chain segments at each vertex of the triangle. All of the connections connect to the same chain segment of space which facilitates a dynamic interaction. Recall that geometry does not exist. All vertices attach to the same space chain segment path.

A triangle seems to be the simplest structure that could exist in DCT, and the approach worked well. We call the triangle without the attaching chain segments the *core triangle*.

7.2 Baryon quantum numbers

The baryon quantum numbers are:

- Strangeness – *Strangeness*, S, comes directly from the sum of the donut links contained in the core triangle. Strangeness equals the sum of the donut links minus 17.
- Isospin – *Isospin*, I_3, components come from the baryon core triangle, ${}_{core}I_3$, and the external segments connecting the core vertices to space chain segments, ${}_{ext}I_3$.

  Core isospin, ${}_{core}I_3$, equals the core apex charges multiplied by 3/4. This sums the total charge for all three states in the two adjacent triangle side segments($x\,3$); spreads the side segment isospin over its ends($/\,2$); and, averages the two segments($/\,2$). Averaging versus summing means ${}_{core}I_3$ calculates as half compared to ${}_{core}q$ for each apex. This provides one of the clues for the relationship of *spin* to *charge*.

  External isospin, ${}_{ext}I_3$, equals the connecting segment charge.
- Spin – *Spin*, s, equals the sum of the isospin contributions of each core vertex, ${}_{core}I_3$, and their external chain segments, ${}_{ext}I_3$. The external chain segment connects with a space chain link with matching phase, except for the Xi^0 particle.

  The decay of the Xi^0 baryon provides the clue needed to help understand how spin comes from isospin. One of the Xi^0 vertices connects with a counter-phase chain link (i.e., two links separated from the in-phase chain link). The Xi^0 decay to $Lambda^0$ retains the isospin at each vertex, but electromagnetically moves the counter-phase connection to an in-phase connection. This changes the spin by twice the isospin of that connection. The Xi^0 decay is the only major baryon decay that happens electromagnetically.

  Other connecting legs could also attach counter-phase, but are hidden because their isospin is zero; or, cancels the isospin in another counter-phase attachment.
- Side Segment Charge – *Charge*, ${}_{side}Q_i$, equals minus the number of *short-side* twists in a chain segment during state i. Recall that the apices are either 0° or 180° in order to form a consistent connection with an external space chain segment. Charge can be negative (short-side twist) or positive (long-side twist). A double charge (double twist) can occur.

The baryon quantum numbers are (continued):

- Hypercharge – *Hypercharge*, Y, for the baryon octet equals B plus S; or, the sum of the side segment charges, ${}_{side}Q_i$, for any state i. Note that Y remains constant for all three states.
- Color – *Color* corresponds with what I call *state*. Suvankar Majumder of Kolkata, India pointed this out to me.
- Quark – A *Quark* is the combined average effect of two sides of the core triangle and the connecting leg attached to the same vertex. The core charge for a quark equals the average over three states of the sum of the charges on the two sides. The external charge equals the charge on the external connecting leg. For a strange quark the core charge is $-4/3$ and the connecting leg charge is $+1$. For an up quark the core charge is $+2/3$ and connecting leg charge is 0. For a down quark the core charge is $+2/3$ and connecting leg charge is -1.

7.3 Three states

Three states exist in the core triangle due to the external vertex connections moving to the next link in the core perimeter chain segments. This means that *spin* must be present in the core triangle. The total net charge in all three sides, called *hypercharge*, remains constant. *Three states* leads to fractional 1/3 charge units.

Particularly note that the sum of the apex charges ${}_{core}q_3$ equals only half of the hypercharge, Y. This figures prominently in the Gell-Mann – Nishijima formula.

7.4 Core triangles

The number of space elements (i.e. chain links) contained in a *core triangle's* perimeter vary directly with the Strangeness number. The number of space elements equals 17 plus the negative Strangeness number, S. Look at the core triangles in the next page.

The numbers shown in the core triangles equal the space element count (i.e. chain link count) in each core triangle side. The side charge can be 0, -1, +1, -2, or +2. Core triangles can have all vertices in the same phase, 0° or 180°. Alternatively, one of the vertices can be in the opposite phase as the other two vertices. If a side has two ends of a side in phase, then 4 elements would be zero charge. If a side has two ends in opposite phase, then 6 elements would be zero charge. Differences from zero charge can be positive or negative depending on the twist direction of the side.

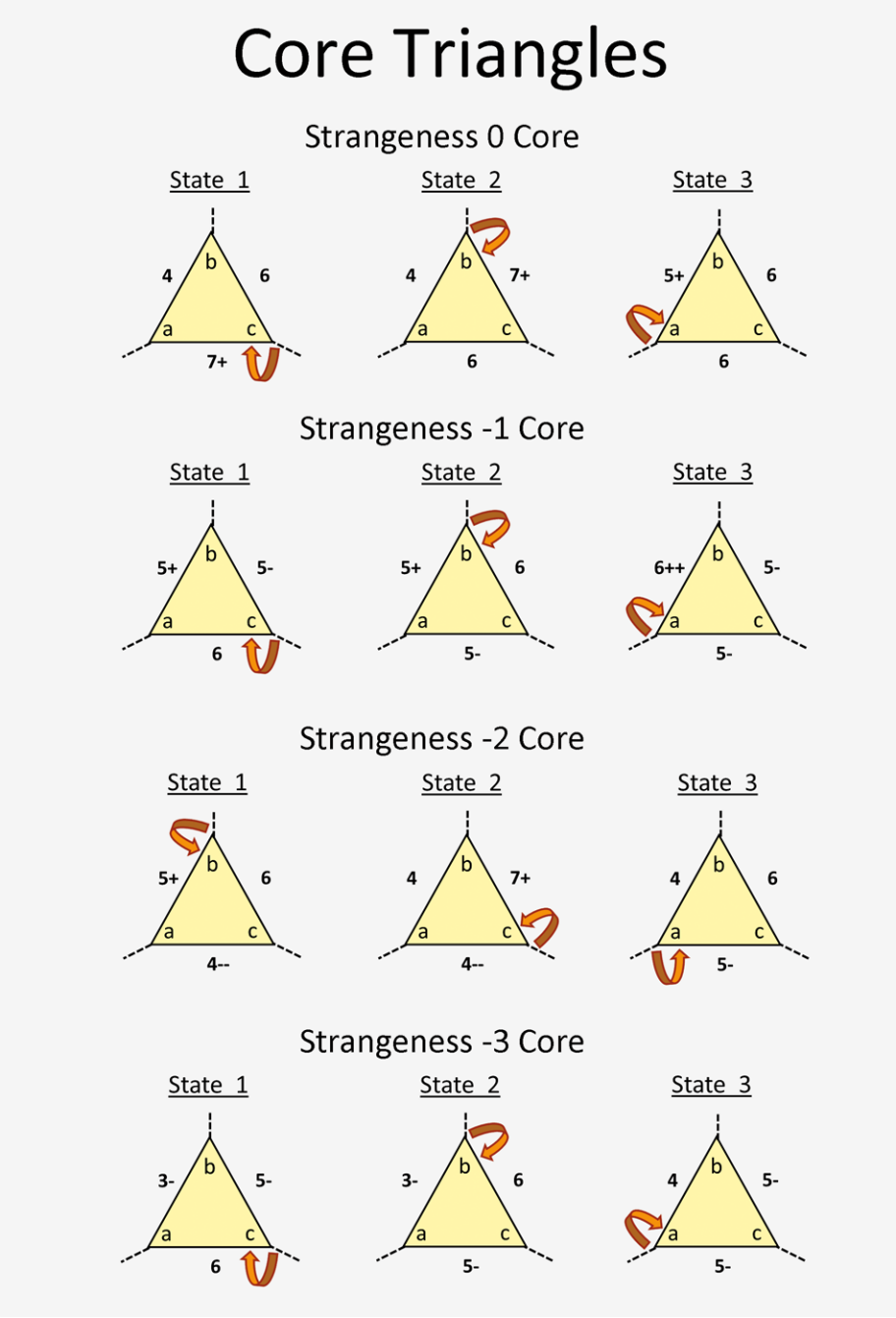


Figure 7.1: Strangeness Core Triangles.

7.5 Connecting chain segments

All apices of a *core triangle* attach to the same chain segment path in space. This needs to happen in order for the particle to travel a path through space. A *connecting chain segment* can have a charge twist of plus, minus, or neutral. The apex core isospin adds algebraically to the connecting chain segment isospin.

Usually the connecting chain segment attaches to a phase matching element in space. In the Sigma-0 particle we find that it connects counter phase. This apparently leads to an additive effect for the charge, but reverses the isospin effect on spin.

7.6 Gell-Mann−Nishijima formula

The Gell-Mann−Nishijima formula, originally given by Kazuhiko Nishijima and Tadao Nakano in 1953 and proposed independently by Murray Gell-Mann in 1956, states:

$$Q = I_3 + \frac{1}{2}(B + S) \quad \text{or,} \quad Q = I_3 + \frac{1}{2}Y \tag{1}$$

Separate the core and external connecting segment components:

$$I_3 = {}_{\text{ext}}I_3 + {}_{\text{core}}I_3 \tag{2}$$

From section 7.2 add all three apices:

$${}_{\text{ext}}I_3 = {}_{\text{ext}}Q \quad \text{and,} \quad {}_{\text{core}}I_3 = \frac{3}{4} \cdot 2Y \tag{3}$$

Substitute equations (3) into (2) into (1):

$$Q = {}_{\text{ext}}Q + 2Y \tag{4}$$

This presentation shows total charge is the sum of charge in the connecting leg segments and double the hypercharge. The Sigma-0 particle maintains this charge relationship, but its spin equals one due to the counter phase connection made by the down quark with the fabric of space. This gives a clue for the effect of *charge* on *spin*.

A charge that moves from an external charge to a core charge doubles its effect. The charge effects both ends of the core segment.

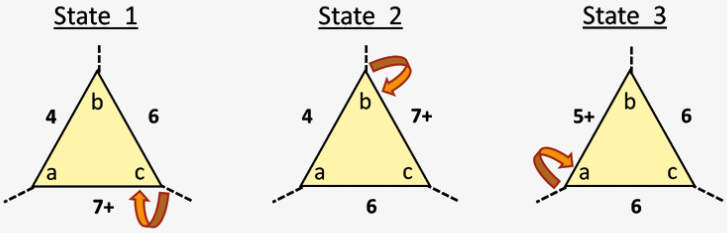
7.7 Particle triangles

The following pages show the complete *particle triangles* for each particle in the primary baryon octet. Notice the Sigma-0 isospin sign reversal. Other vertices may also connect in a contra-spin manner, but have zero or canceling isospins.

Particle Triangles

(B = 1, S = 0, Y = +1, N = 17)

core state



core side charge

state	ab	bc	ca
1	0	0	+1
2	0	+1	0
3	+1	0	0
average	+1/3	+1/3	+1/3

core apex sum

	a	b	c
charge	+2/3	+2/3	+2/3
I_3	+1/2	+1/2	+1/2

external apex charge (= I_3)

proton	0	-1	0
neutron	0	-1	-1

total charge, isospin & spin

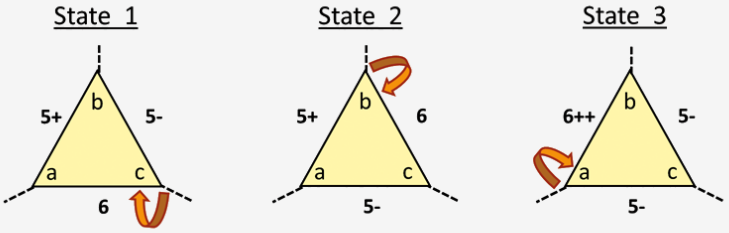
proton-chg	+2/3(u)	-1/3(d)	+2/3(u)
$I_3 \rightarrow S$	+1/2	-1/2	+1/2
neutron-chg	+2/3(u)	-1/3(d)	-1/3(d)
$I_3 \rightarrow S$	+1/2	-1/2	-1/2

Figure 7.2: Strangeness 0 Core Triangle.

Particle Triangles

(B = 1, S = -1, Y = 0, N = 16)

core state



core side charge

state	ab	bc	ca
1	+1	-1	0
2	+1	0	-1
3	+2	-1	-1
average	+4/3	-2/3	-2/3

core apex sum

	a	b	c
charge	+2/3	+2/3	-4/3
I_3	+1/2	+1/2	-1

external apex charge (= I_3)

Λ^0	0	-1	+1

total charge, isospin & spin

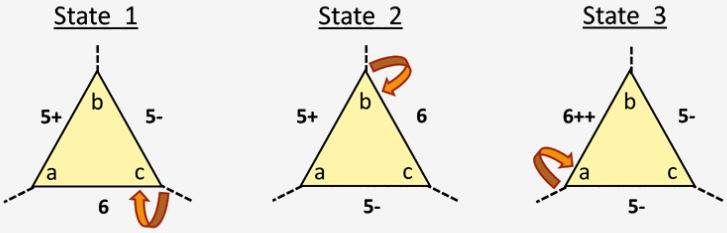
Λ^0 charge	+2/3(u)	-1/3(d)	-1/3(s)
$I_3 \rightarrow S$	+1/2	-1/2	0

Figure 7.3: Strangeness -1a Core Triangle.

Particle Triangles

(B = 1, S = -1, Y = 0, N = 16)

core state



core side charge

state	ab	bc	ca
1	+1	-1	0
2	+1	0	-1
3	+2	-1	-1
average	+4/3	-2/3	-2/3

core apex sum

	a	b	c
charge	+2/3	+2/3	-4/3
I_3	+1/2	+1/2	-1

external apex charge (= I_3)

Σ^+	0	0	+1
Σ^0	0	-1	+1
Σ^-	-1	-1	+1

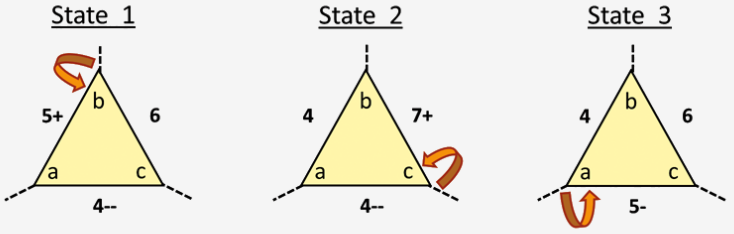
total charge, isospin & spin

Σ^+ charge	+2/3(u)	+2/3(u)	-1/3(s)
$I_3 \rightarrow S$	+1/2	+1/2	0
Σ^0 charge	+2/3(u)	-1/3(d)	-1/3(s)
$I_3 \rightarrow S$	+1/2	-1/2 → +1/2	0
Σ^- charge	-1/3(d)	-1/3(d)	-1/3(s)
$I_3 \rightarrow S$	-1/2	-1/2	0

Figure 7.4: Strangeness -1b Core Triangle.

Particle Triangles

(B = 1, S = -2, Y = -1, N = 15)



core side charge

state	ab	bc	ca
1	+1	0	-2
2	0	+1	-2
3	0	0	-1
average	+1/3	+1/3	-5/3

core apex sum

	a	b	c
charge	-4/3	+2/3	-4/3
I_3	-1	+1/2	-1

external apex charge (= I_3)

Ξ^0	+1	0	+1
Ξ^-	+1	-1	+1

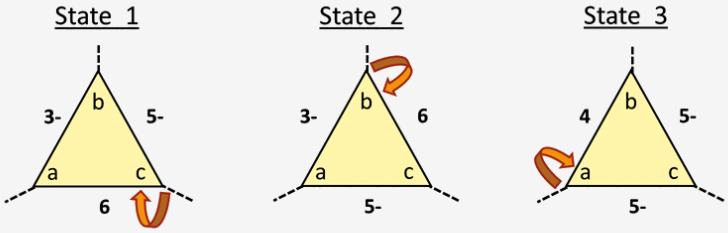
total charge, isospin & spin

Ξ^0 charge	-1/3(s)	+2/3(u)	-1/3(s)
$I_3 \rightarrow S$	0	+1/2	0
Ξ^- charge	-1/3(s)	-1/3(d)	-1/3(s)
$I_3 \rightarrow S$	0	-1/2	0

Figure 7.5: Strangeness -2 Core Triangle.

Particle Triangles

(B = 1, S = -3, Y = -2, N = 14)



core side charge

state	ab	bc	ca
1	-1	-1	0
2	-1	0	-1
3	0	-1	-1
average	-2/3	-2/3	-2/3

core apex sum

	a	b	c
charge	-4/3	-4/3	-4/3
I_3	-1	-1	-1

external apex charge (= I_3)

Ω^-	+1	+1	+1

total charge, isospin & spin

Ω^- charge	-1/3(s)	-1/3(s)	-1/3(s)
$I_3 \rightarrow S$	0	0	0

Figure 7.6: Strangeness -3 Core Triangle.

7.8 Baryon decay paths

The illustrations on the following pages show the core triangles, external charges, and decay paths for the baryons in the major octet. All decays are considered to be started externally for particle collisions from a change in a connecting segment leg. Even the collision decays that result only in a core change are considered to be started externally from changes in charge potential. Another class of particle changes would occur from neutrinos incorporating themselves into the molecular structure. Figure 7.1. shows the core triangles for each strangeness number, S. Note that N, the number of chain links (space elements), decreases by 1 for each decrease in S. Apex phases are either 0° or 180°.

7.9 Baryon decay triangles

The *baryon decay triangles* provide a visual for the baryon octet decay paths. The concept of a triangle only provides a visual organization of the core relationships. There is no geometry at this level.

No attempt has been made to reconcile DCT triangles to quantum chromodynamics (QCD). Such efforts seem challenging, especially for mass calculations. Exercise a degree of skepticism when looking at these decay triangles. The illustrated triangles are meant more for *proof of concept* than for an accurate and definitive explanation of the processes.

The reader should remember that DCT makes no claim of replacing QCD. If DCT adds an element of perspective to some aspects of QCD that would be good.

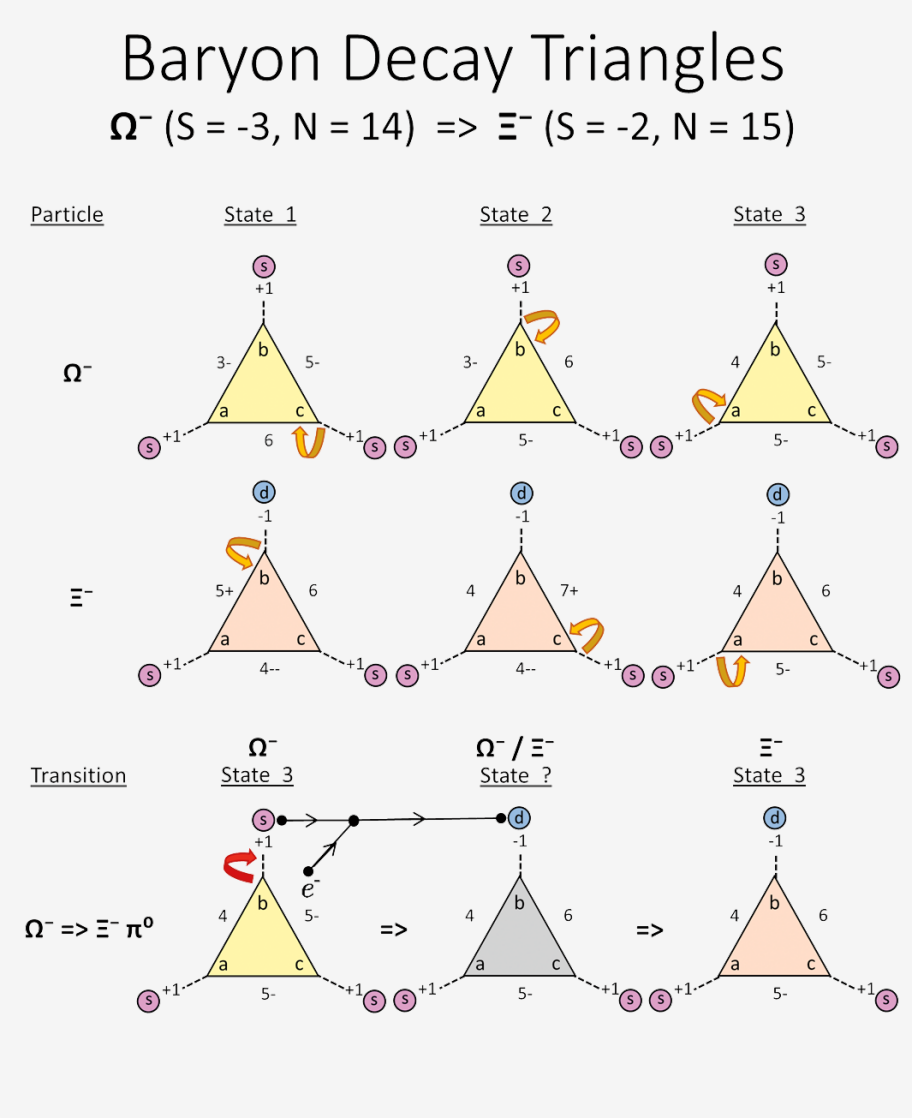


Figure 7.7: Omega-minus to Xi-minus decay.

The Omega-minus decays a strange quark into an up quark immediately balanced by adding a negative charge to change the resulting up quark to a down quark. The strange quark decay moves a plus charge from a connecting leg into the core where it has double the effect. The negative charge added to the connecting leg balances the charge increase from moving the positive charge into the core.

Pions and kaons have not been considered under DCT.

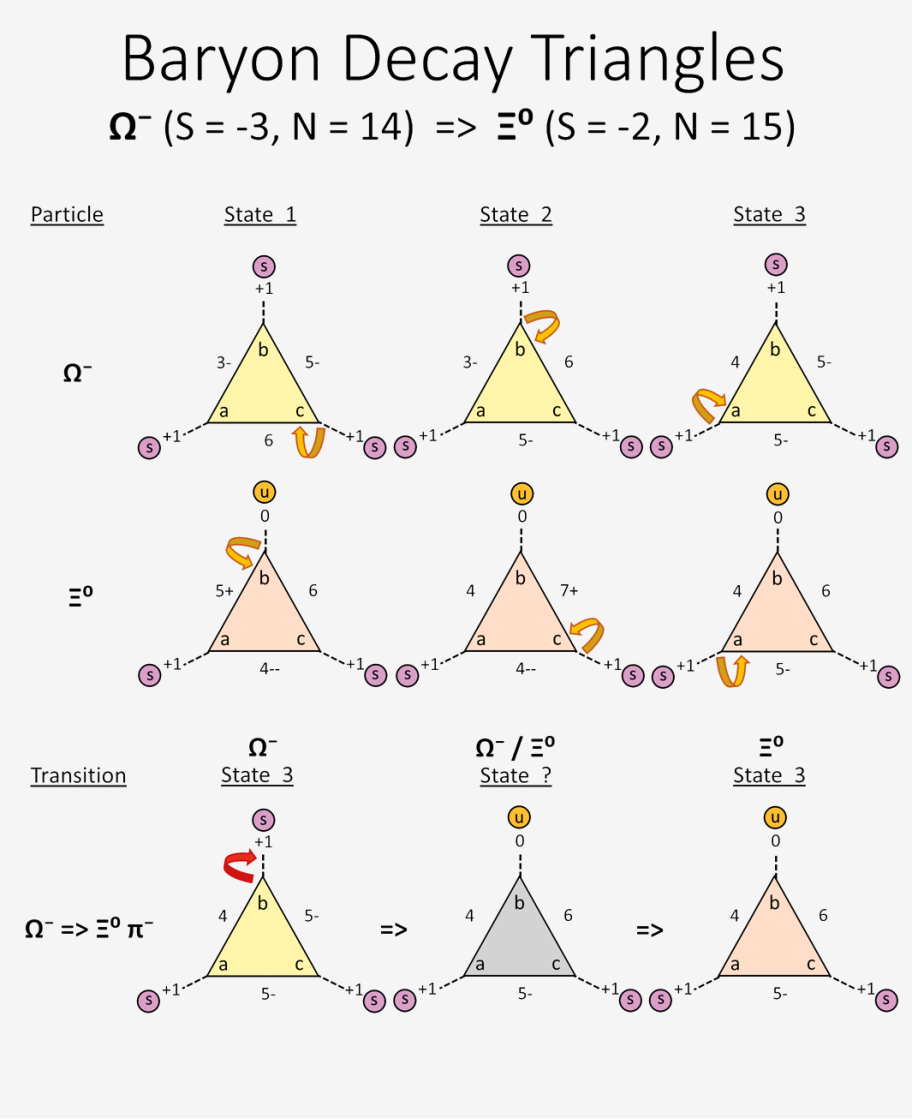


Figure 7.8: Omega-minus to Xi-zero decay.

This decay is the same as the Omega-minus to Xi-minus except the negative charge has not been added to the up quark connecting segment.

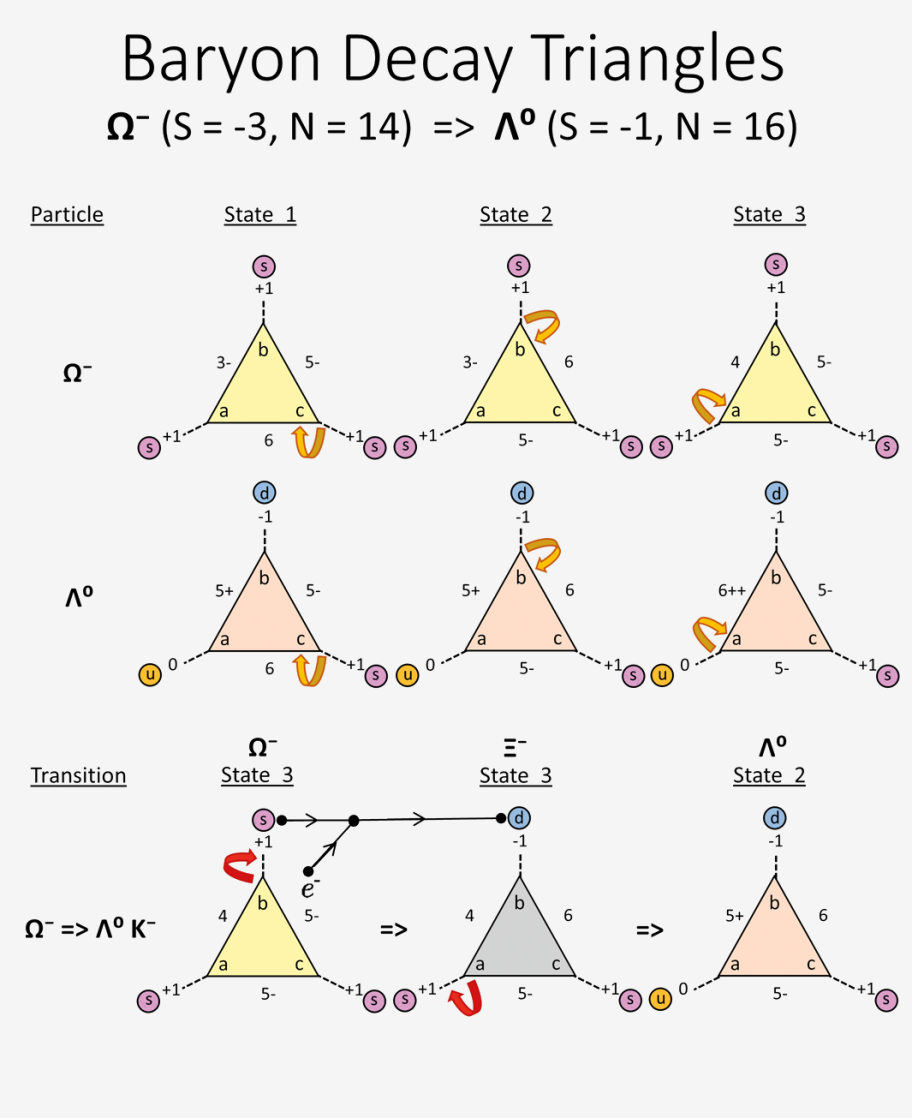


Figure 7.9: Omega-minus to Lambda-zero decay.

This is an interesting decay in that it takes a two-stage decay path with Xi-minus being an intermediate particle. Possibly, it doesn't add the negative charge until the final stage in which case the intermediate particle would be Xi-zero. If the negative charge is added at the beginning of the decay then the first half of this decay looks like the Omega-minus to Xi-minus decay.

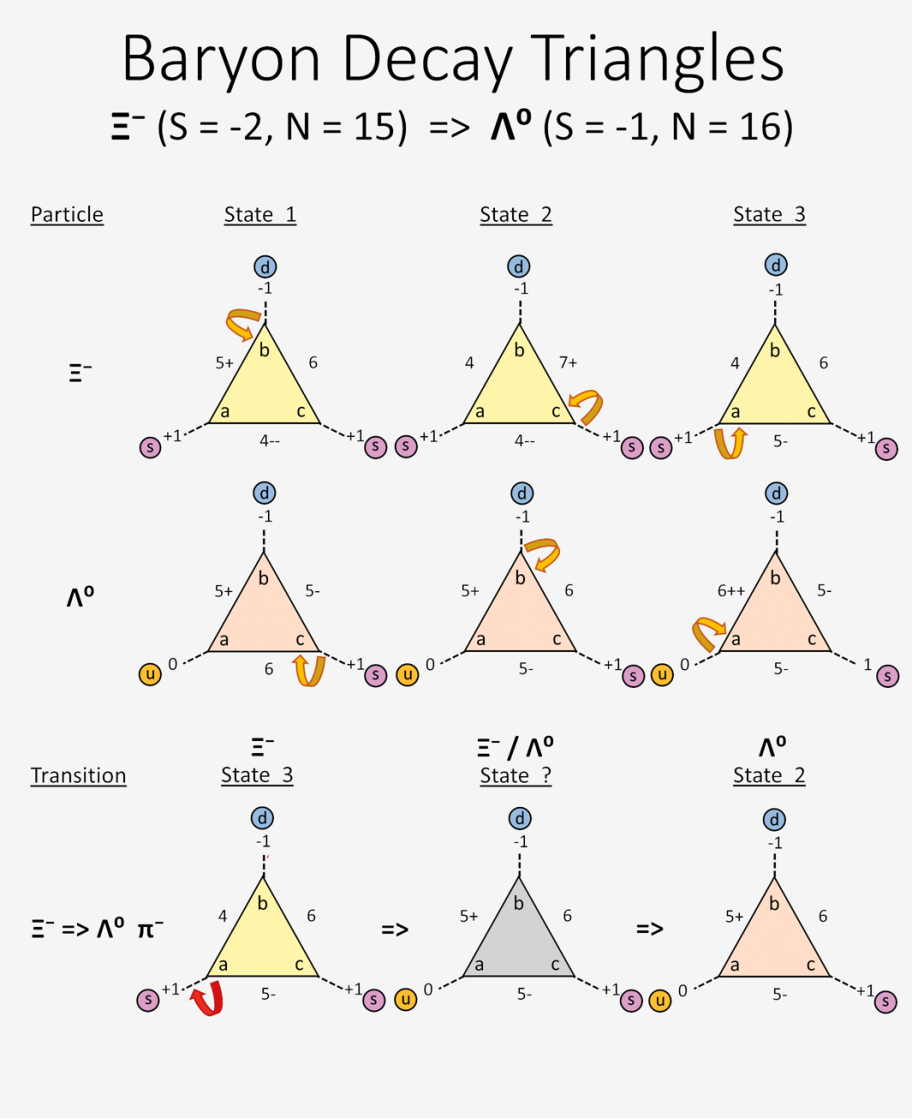


Figure 7.10: Xi-minus to Lambda-zero decay.

This decay changes a strange quark into an up quark. The pi-minus needs to be a negatively charged particle to represent the doubled positive charge that results from moving the charge from the a-leg into the core.

Pions and kaons have not been considered under DCT.

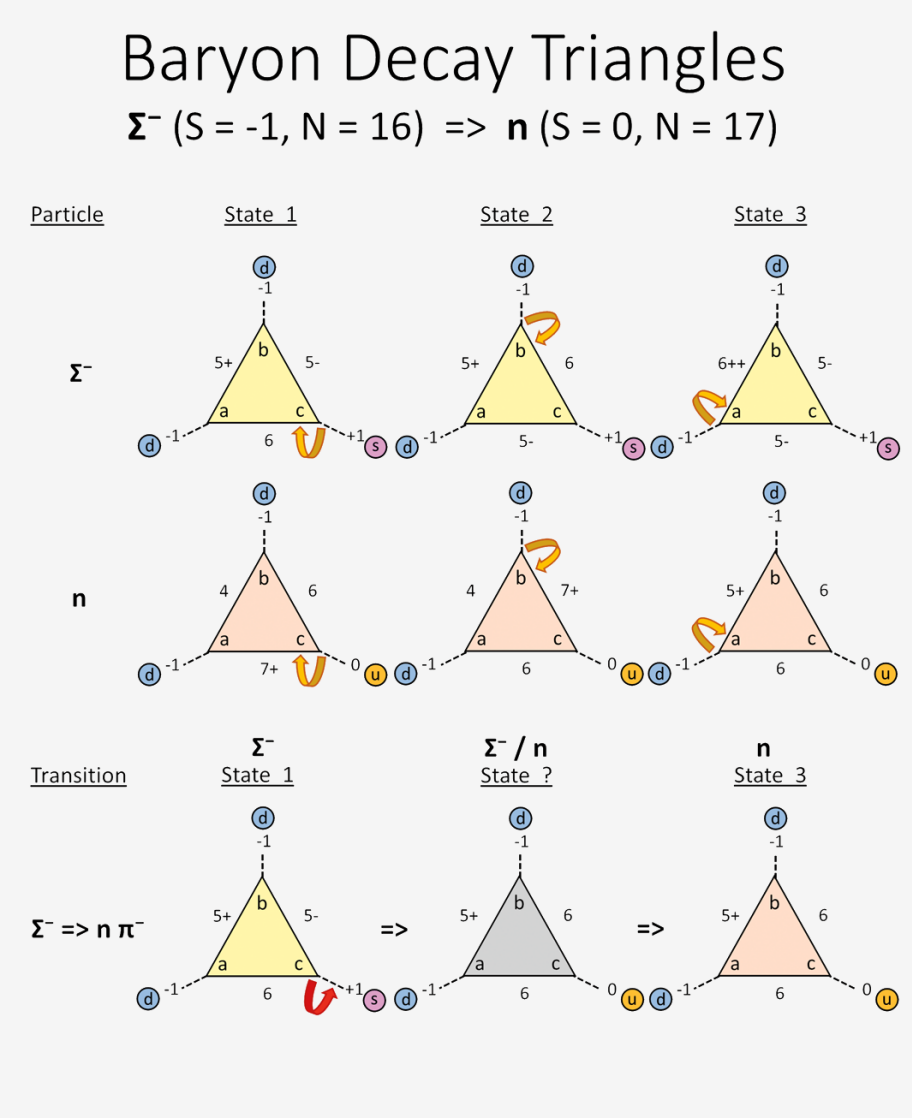


Figure 7.11: Sigma-minus to neutron decay.

This decay changes a strange quark into an up quark. The pi-minus needs to be a negatively charged particle to represent the doubled positive charge that results from moving the charge from the a-leg into the core.

Pions and kaons have not been considered under DCT.

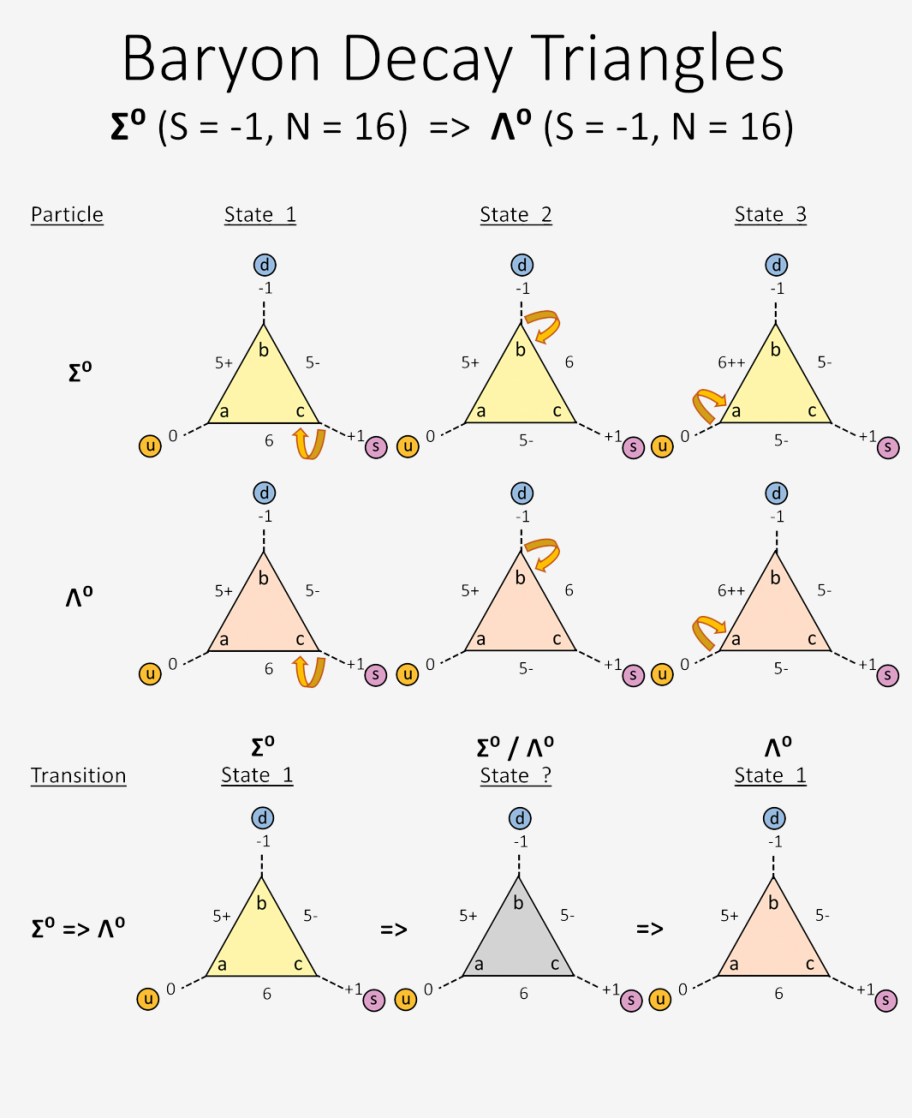


Figure 7.12: Sigma-zero to Lambda-zero decay.

This is the only major baryon that decays electromagnetically. There are no obvious changes except the spin changes from one to zero. Figure 7.12. helps us better understand the external segment connection of the core triangle to a strand of space. The Sigma-0 baryon has its apex b. connection with space 180° out of phase. The charge connects okay, but the spin subtracts rather than adds for the apex. The Lambda-0 particle adds spin normally.

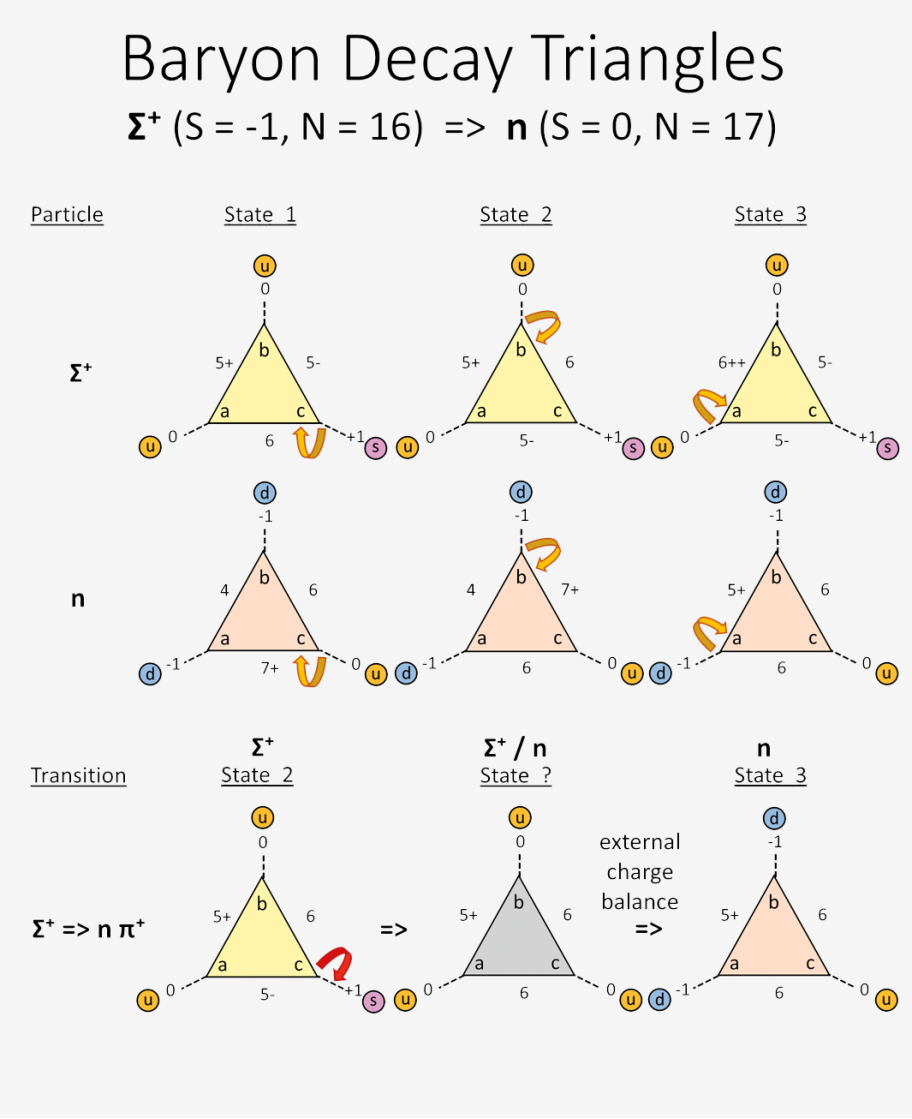


Figure 7.13: Sigma-plus to neutron decay.

This is a puzzling decay. I don't know how the two up quarks become down quarks. I label it *external charge balance*, but don't really know how the underlying process progresses.

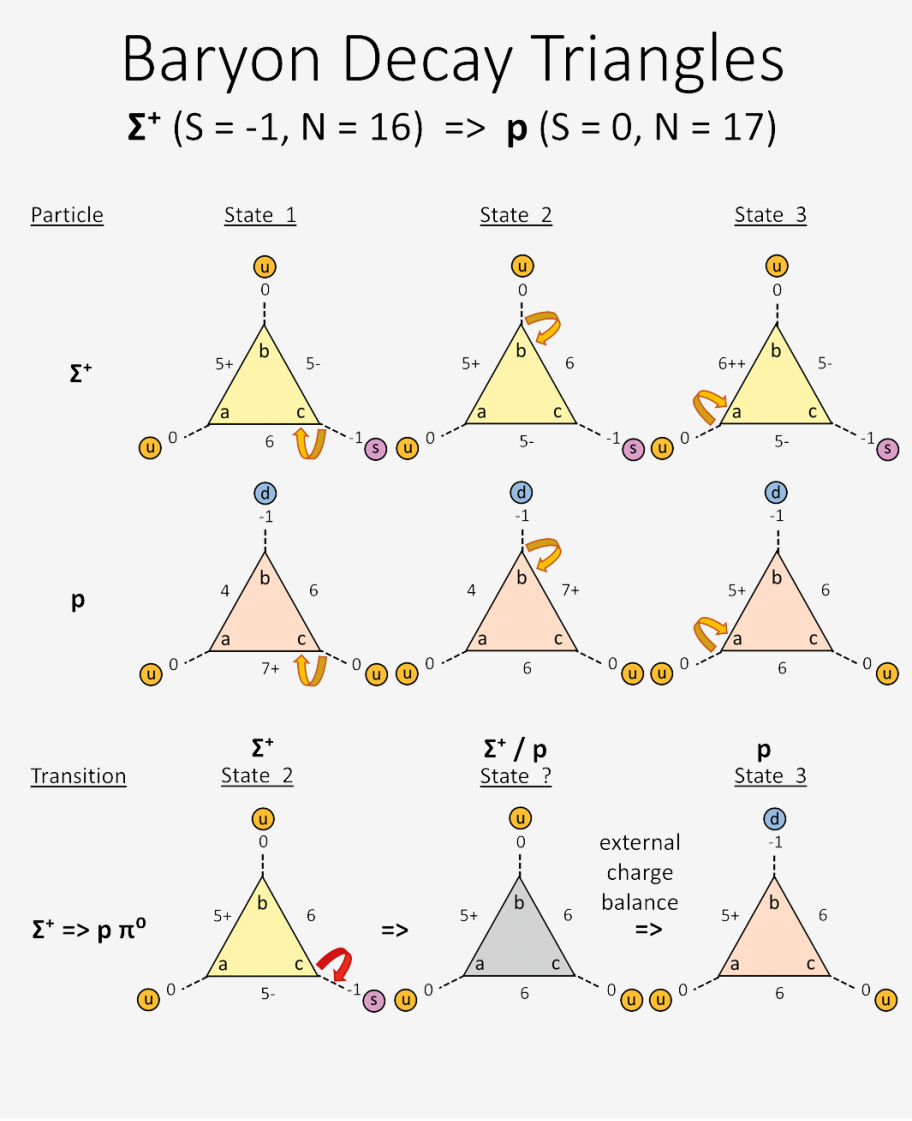


Figure 7.14: Sigma-plus to proton decay.

This decay is similar to the Sigma-plus to neutron decay; except, only one of the up quarks changes to a down quark. I label it *external charge balance*, but don't really know how the underlying process progresses.

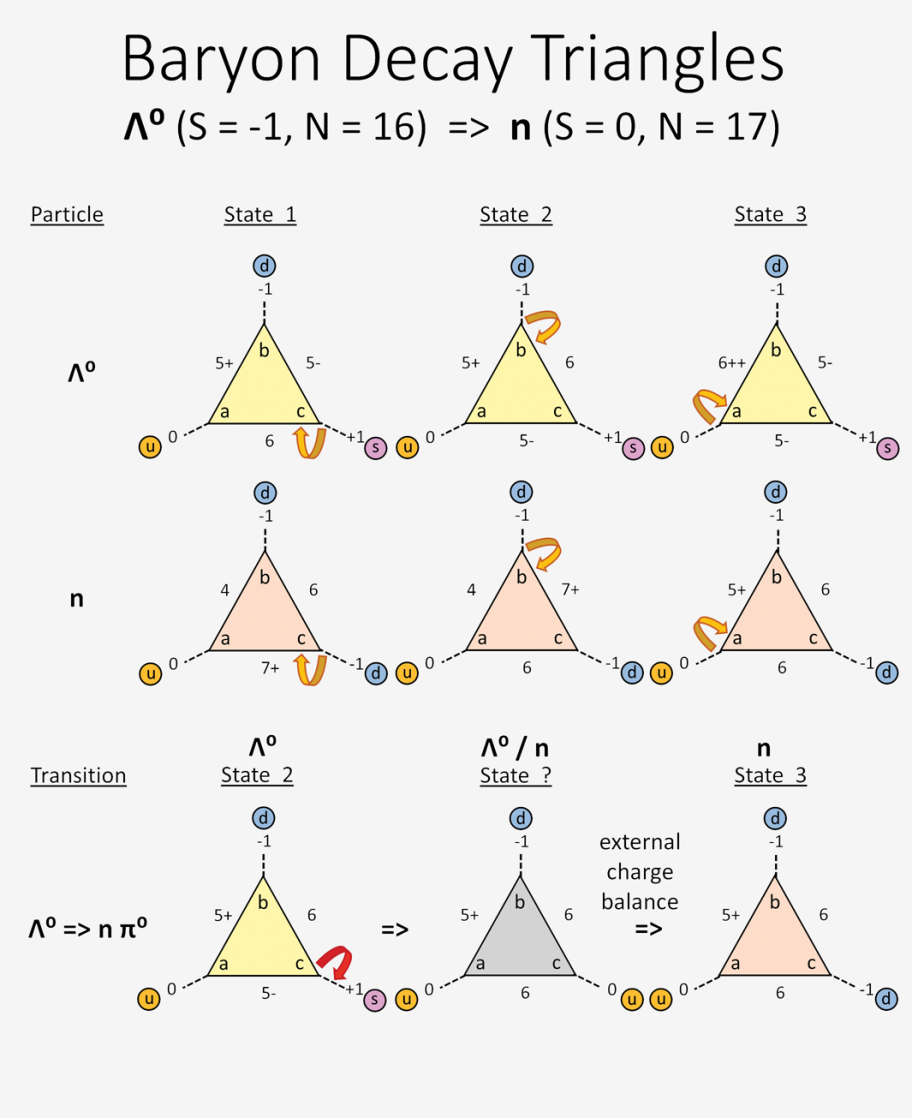


Figure 7.15: Lambda-zero to neutron decay

This decay is similar to the Sigma-plus to neutron decay; except, only one of the up quarks changes to a down quark. I label it *external charge balance*, but don't really know how the underlying process progresses.

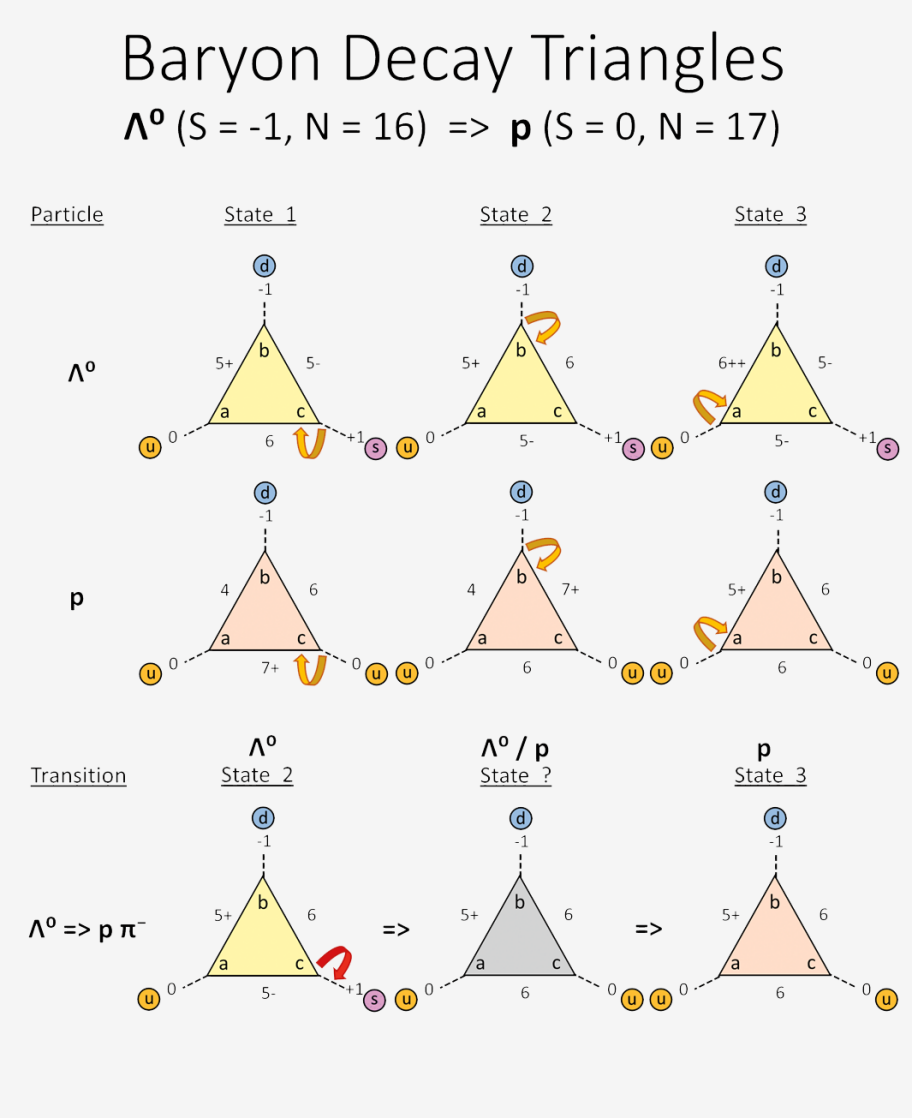


Figure 7.16: Lambda-zero to proton decay.

This decay is similar to the Lambda-zero to neutron decay; except, only the strange quark changes to an up quark., the effect of the positive charge doubles in the core from what it was in the connecting leg.

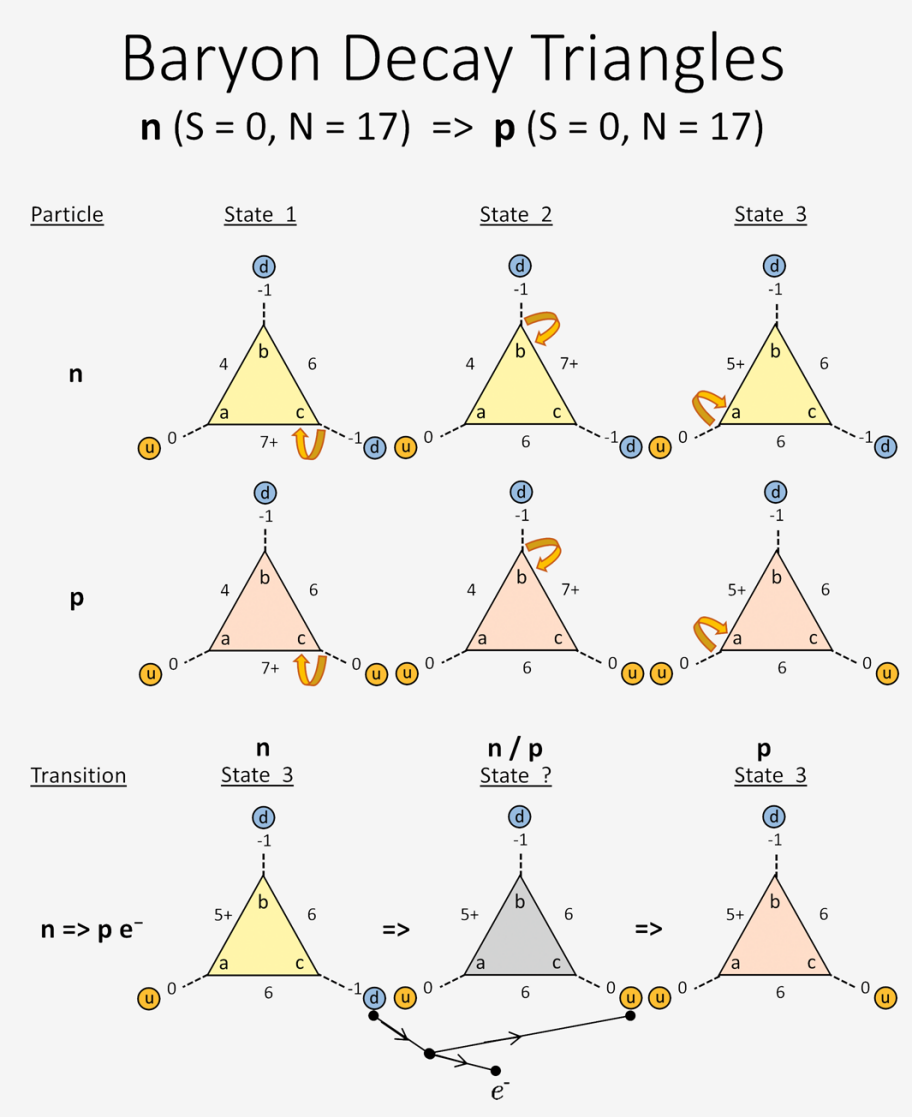


Figure 7.17: neutron to proton decay.

The beta decay shown simply expels an electron from a connecting leg of the neutron to change it into a proton. It does this by a space element penetrating into the particle configuration. This cancels the negative charge in a connecting leg and creates the external electron.