

# On the Baryon System in View of Period Doubling

Baryon Magnetic Moments

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# Introduction

In the period doubling model the magnetic moment  $\mu$  of a particle is described by a 3-d part and a 4-d part independently (same way as with energy).

Both parts are subject to period doubling (due to nonlinearity).

The magnetic moment  $\mu_{NM}$  of a particle can be expressed by

$$\mu_{NM} = 2^N 2^M \mu_{ref}$$

where  $N$  (=integer/3) and  $M$  (=integer/4) represent doublings in the 3-d part and 4-d part respectively.  $\mu_{ref}$  is the reference magnetic moment.

# Magnetic Moment Data

<b>Particle</b>	<b><math>\mu</math> (Am<sup>2</sup>)</b>
Proton	1,41E-26
Neutron	9,66E-27
Lambda	3,10E-27
Sigma+	1,24E-26
Sigma o	8,13E-27
Sigma-	5,86E-27
Xi o	6,31E-27
Xi -	3,29E-27
Omega -	1,02E-26

Baryon magnetic moments  
(absolute values converted  
from nuclear magnetons into  
SI-units).

Source: <http://pdg.lbl.gov>

# Magnetic Moment Structures

$\mu_{NM}$	$\mu$ (Am <sup>2</sup> )	N+M	N	M
p	1,41E-26	65,001	65,001	0,000
p-n	4,44E-27	63,335	63,335	0,000
2p-Lambda	2,51E-26	65,833	65,333	0,500
2p-Sigma+	1,58E-26	65,164	64,664	0,500
2p-Sigma-	2,24E-26	65,665	65,665	0,000
2n-Sigma o	1,12E-26	64,667	64,667	0,000
4p-Xi o	5,01E-26	66,830	66,330	0,500
4p-Xi -	5,31E-26	66,914	66,664	0,250
(4p-Xi o) -Omega -	3,99E-26	66,501	66,001	0,500

$$\mu_{NM} = 2^N 2^M \mu_{ref}$$

$$N + M = \frac{\ln(\mu_{NM} / \mu_{ref})}{\ln(2)}$$

Values are calculated using absolute  $\mu$  values, reference is the radial Planck magnetic moment <sup>1</sup>  
 $\mu_{ref} = \mu_{orad} = 3.8208 \cdot 10^{-46} \text{ Am}^2$ .

*p-n* means  $\mu_p - \mu_n$ , others correspondingly.

Doubling on the electromagnetic side ( $M = \text{integer}/4$ ) has been assumed accurate and  $N$  has been calculated from the experimental  $N+M$ . Note that  $N$  (integer/3) agrees very closely with model values (decimals 0, 1/3 and 2/3).

<sup>1</sup> Ari Lehto, On the Planck Scale and Properties of Matter, Nonlinear Dynamics, Volume 55, Number 3, 279-298, February, 2009

# Baryon Magnetic Moment Structures

Proton, Neutron and Lambda

$$\mu_{NM} = 2^N 2^M \mu_{ref}$$

$$\frac{\mu_p}{\mu_{orad}} = 2^{65.00} \cdot 2^{0.00} = 2^{\frac{65+65+65}{3}} \cdot 2^{\frac{0+0+0+0}{4}}$$

Shape: (65,65,65;0,0,0,0)

$$\frac{\mu_n}{\mu_{orad}} = 2^{65.00} \cdot 2^{0.00} - 2^{65.33} \cdot 2^{0.00}$$

$$\frac{\mu_\Lambda}{\mu_{orad}} = 2^{66.00} \cdot 2^{0.00} - 2^{65.33} \cdot 2^{0.50}$$

Shapes: (66,66,66;0,0,0,0)  
and (65,65,66;0,0,1,1)

# Baryon Magnetic Moment Structures

Sigma

$$\frac{\mu_{\Sigma^+}}{\mu_{\text{orad}}} = 2^{66.00} \cdot 2^{0.00} - 2^{64.66} \cdot 2^{0.50}$$

$$\frac{\mu_{\Sigma^0}}{\mu_{\text{orad}}} = 2^{66.00} \cdot 2^{0.00} - 2^{64.33} \cdot 2^{0.00} - 2^{64.66} \cdot 2^{0.00}$$

$$\frac{\mu_{\Sigma^-}}{\mu_{\text{orad}}} = 2^{66.00} \cdot 2^{0.00} - 2^{65.66} \cdot 2^{0.00}$$

# Baryon Magnetic Moment Structures

Xi and Omega minus

$$\frac{\mu_{\Xi^0}}{\mu_{\text{orad}}} = 2^{67.00} \cdot 2^{0.00} - 2^{66.33} \cdot 2^{0.50}$$

$$\frac{\mu_{\Xi^-}}{\mu_{\text{orad}}} = 2^{67.00} \cdot 2^{0.00} - 2^{66.66} \cdot 2^{0.25}$$

$$\frac{\mu_{\Omega^-}}{\mu_{\text{orad}}} = 2^{66.33} \cdot 2^{0.50} - 2^{66.00} \cdot 2^{0.50}$$

# Summary

Period doubling generates a series of growing magnetic moments from the Planck magnetic moment.

The baryon magnetic moments seem to be simple combinations of these magnetic moments.

The geometric shape of the 3-d and 4-d parts can be deduced from the  $N$  and  $M$  values.

# Thank You!