INTRODUCTION

In Section I, we discuss the role of hypernucleons in the context of nuclear forces and their implications for the hadron spectrum. We introduce the concept of non-mesonic decay and the significance of the process in understanding the strong interactions. We also present recent experimental results and theoretical developments in this area. The non-mesonic decay of hyperons is a crucial aspect of understanding the dynamics of strong interactions. This process can provide insight into the quark structure of hadrons and the underlying dynamics of the strong force. Theoretical models and experimental results are compared to understand the non-mesonic decay of hyperons.

In Section II, we focus on the experimental aspects of the hypernucleon sector. We describe the experimental setup and the data acquisition methods used in various experiments. We discuss the importance of these experiments in validating theoretical predictions and the role of hypernucleon physics in understanding the strong interactions. We also present recent experimental results and their implications for the hadron spectrum.

In Section III, we discuss the theoretical aspects of the hypernucleon sector. We introduce the various theoretical frameworks used in understanding the hypernucleon sector, including chiral perturbation theory and lattice QCD. We also discuss the role of hypernucleon physics in understanding the quark content of hadrons and the underlying dynamics of the strong force. We present recent theoretical developments and their implications for the hypernucleon sector.

In Section IV, we discuss the implications of hypernucleon physics for the understanding of the strong interactions. We discuss how the study of hypernucleons can provide insights into the quark structure of hadrons and the underlying dynamics of the strong force. We also present recent results and their implications for the hadron spectrum.

In Section V, we discuss the role of hypernucleons in the context of nuclear astrophysics. We introduce the concept of hypernucleon physics in the context of supernova explosions and the role of hypernucleons in understanding the explosive nucleosynthesis in these scenarios. We present recent results and their implications for the understanding of nucleosynthesis in supernova explosions.

In Section VI, we discuss the role of hypernucleons in the context of hadron spectroscopy. We introduce the concept of hypernucleon physics in the context of understanding the structure of hadrons and the quark content of hadrons. We present recent results and their implications for the hadron spectrum.

In Section VII, we discuss the role of hypernucleons in the context of high-energy physics. We introduce the concept of hypernucleon physics in the context of understanding the quark content of hadrons and the underlying dynamics of the strong force. We present recent results and their implications for the understanding of the strong interactions.

In Section VIII, we discuss the role of hypernucleons in the context of future experimental programs. We introduce the concept of hypernucleon physics in the context of understanding the quark content of hadrons and the underlying dynamics of the strong force. We present recent results and their implications for the future experimental programs in the hypernucleon sector.

In Section IX, we discuss the role of hypernucleons in the context of theoretical developments. We introduce the concept of hypernucleon physics in the context of understanding the quark content of hadrons and the underlying dynamics of the strong force. We present recent results and their implications for the theoretical developments in the hypernucleon sector.

In Section X, we discuss the role of hypernucleons in the context of applications. We introduce the concept of hypernucleon physics in the context of understanding the quark content of hadrons and the underlying dynamics of the strong force. We present recent results and their implications for the applications of hypernucleon physics.

In Section XI, we discuss the role of hypernucleons in the context of future research. We introduce the concept of hypernucleon physics in the context of understanding the quark content of hadrons and the underlying dynamics of the strong force. We present recent results and their implications for the future research in the hypernucleon sector.
II. RELATIVISTIC MEAN FIELD MODEL

A. Lagrangian

The framework for our investigations is the relativistic mean field theory (RMFT)[6]. It describes a nucleus as a system of Dirac spinors (nucleons) interacting via meson fields in the mean field approximation. Our aim is to calculate hypernuclear systems and so we extend the original model for ordinary nuclei by the strange particle (Λ, Σ, Ξ) sector. We start from the Lagrangian density of the form

\[ \mathcal{L} = \mathcal{L}_N + \mathcal{L}_Y, \quad Y = \Lambda, \Sigma, \Xi, \]

(1)

\[ \mathcal{L}_Y = \bar{\Psi}_Y \left[ i \gamma_\mu \partial^\mu - g_{\omega Y} \gamma_\mu V^\mu - (M_Y + g_{\phi Y} \phi) \right] \Psi_Y + \mathcal{L}_{\omega Y} + \mathcal{L}_{\lambda Y} + \mathcal{L}_T. \]

(2)

In Eq. (1), \( \mathcal{L}_N \) denotes the standard Lagrangian of the mean field theory for nuclei. Its detailed form can be found elsewhere[6, 7]. \( \mathcal{L}_N \) involves nucleons (\( \Psi_N \)), scalar \( \sigma \) mesons (\( \phi \)), vector \( \omega \) mesons (\( V^\mu \)), vector isovector \( \rho \) mesons (\( \tilde{V}^\mu \)) and the photon (\( A^\mu \)) (for the Coulomb field). In the case of the nonlinear model the scalar meson self-couplings are included as well:

\[ \mathcal{L}_{\omega Y} = \frac{1}{2} m_\omega^2 \phi^2 - \frac{1}{2} m_\phi^2 \phi^2. \]

(3)

In general, the \( \mathcal{L}_Y \) contains contributions \( \mathcal{L}_{\omega Y} \) and \( \mathcal{L}_{\lambda Y} \) from the interactions of a hyperon with the \( \rho \) meson and Coulomb field, respectively. For a particular hyperon they acquire the following form:

\[ \mathcal{L}_{\omega Y} = \mathcal{L}_{\lambda Y} = 0, \]

(4)

\[ \mathcal{L}_{\omega Y} + \mathcal{L}_{\lambda Y} = -\bar{\Psi}_Y \left[ \frac{1}{2} g_\omega \bar{\Sigma} - \tilde{V} \gamma_\mu \right] \gamma_\mu \psi_Y + \frac{1}{2} (\gamma_5 \gamma_\mu \gamma_\rho) A^\mu \right] \bar{\Psi}_Y, \]

(5)

\[ \mathcal{L}_{\lambda Y} = \mathcal{L}_{\lambda Y} = -\bar{\Sigma} \left( \frac{g_\lambda}{2} \bar{\Sigma} \gamma_\mu \gamma_\rho + \frac{1}{2} \gamma_5 \gamma_\mu \gamma_\rho \right) \Sigma_\mu \]

(6)

where

\[ \Sigma_{\mu} = \begin{pmatrix} \Psi_{\mu} & \sqrt{2} \Psi_{\mu} \\ \sqrt{2} \Psi_{\mu} & -\Psi_{\mu} \end{pmatrix}, \]

(7)

and

\[ \Theta_{\mu} = \begin{pmatrix} \rho^\mu & \sqrt{2} \rho^\mu \\ \sqrt{2} \rho^\mu & -\rho^\mu \end{pmatrix}. \]

(8)

Finally, we included the Lagrangian density \( \mathcal{L}_T \) that describes the \( \omega-Y \) anomalous coupling term,

\[ \mathcal{L}_T = \frac{f_{\omega Y}}{2 M_Y} \bar{\Sigma} \gamma_\mu \gamma_\rho \partial_\mu \psi_Y \]

(9)

In the following we neglect the contributions of anti(quasi)particles (so called "no-sea" approximation) and quantum fluctuations of meson fields ("mean-field" approximation). Using standard variational techniques we arrive at a system of the Dirac and Klein-Gordon equations for baryons and meson fields, respectively. In the static limit they acquire the form:

\[ [-\Delta + m_\omega^2] B_\omega = \sum_i g_{\omega \rho} \rho_{\omega i} - \delta_{\omega \rho} \delta_{\rho \rho} \frac{f_{\omega \rho}}{2 M_Y} \rho_{\rho} + \delta_{\omega \rho} \delta_{\rho \rho} \left(-g_\omega \psi^\phi - g_\phi \phi^3 \right), \]

(10)

\[ (-\Delta + m_\phi^2) \rho_\phi = \sum_i g_{\omega \rho} \rho_{\omega i} - \delta_{\omega \rho} \delta_{\rho \rho} \frac{f_{\omega \rho}}{2 M_Y} \rho_{\rho} + \delta_{\omega \rho} \delta_{\rho \rho} \left(-g_\omega \psi^\phi - g_\phi \phi^3 \right), \]

(11)

\[ \Delta \rho_\phi = \sum_i \rho_{\omega i}, \]

(12)

where

\[ B_\omega = \phi, \quad B_\omega = V_\omega, \quad B_\rho = \tilde{V}, \quad B_\rho = b_0, \]

and \( I_\alpha \) and \( Q_\alpha \) are the third isospin component and the charge of the baryon, respectively.

The densities in Eqs.(11) and (12) are defined as:

\[ \rho_{\omega i} = \sum_{\alpha} \bar{\Psi}_\omega \rho_{\omega i} D_j \bar{\Psi}_i, \quad j = \sigma, \omega, \tilde{\rho}, \rho \]

\[ \rho_{\omega i} = \sum_{\alpha} \bar{\Psi}_\omega \rho_{\omega i} D_{\omega}, \]

\[ \rho_{\omega i} = \tilde{V} \cdot \sum_{\alpha} \bar{\Psi}_\omega \rho_{\omega i} \tilde{\rho}, \]

\[ D_\sigma = -\gamma_5, \quad D_\omega = \gamma_0, \quad D_\rho = \gamma_0 I_3, \]

where in summations \( \alpha \) runs over all occupied particle states.

Hypernuclei studied here are systems with one hyperon added to a spherical (closed shell) nuclear core. Such systems with an odd number of particles are no longer time-reversal invariant[34, 35]. As a consequence, the spatial components of vector fields and baryon currents in Eqs. (10)-(11) do not vanish. They have been
A. Shell model for function

II. 3. AND 2. HYPOTHESES

where the expression is described with matrix expressions.

Underneath, there is an expression and a large volume, according to a formula:

\[ \Omega = (N^{\mu}N^\nu - N^{\mu}N^\nu) - v^a N^\mu N^\nu - v^b N^\mu N^\nu \]

In the expression, the term \( \Omega \) is expanded with the product and the second term is expanded with the product, where the expression is described with matrix expressions.

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and \( f_{\omega A}/g_{\omega A} = -1 \). The figure shows a good agreement (within experimental errors \( \approx 1 \) MeV) of the RMFT results with the data from \((\pi^+, K^+)\) production\[41\]. The evolution of binding energies of a neutral \( \Sigma^0 \) is similar to that of \( \Lambda \) in Fig. 1 as long as we assume the same strength of \( \Lambda \) and \( \Sigma \) coupling in nuclear medium.

Figure 2 demonstrates the importance of the Coulomb and isovector (\( \rho \) meson) interactions in \( \Sigma^+ \) hypernuclei. The following discussion is valid however for \( \Xi \) hypernuclei, as well\[50\]. The attractive Coulomb interaction (Fig. 2(a)) leads to a considerably stronger binding of \( \Sigma^- \) (\( \Xi^- \)) in nuclear medium when compared with neutral hyperons \( \Lambda, \Sigma^0 \) and \( \Xi^0 \). This allows the population of highly excited hypernuclear states\[16\]. For \( \Sigma^+ \) the repulsive Coulomb potential decreases the binding of the \( \Sigma^+ \) hyperon (Fig. 2(b)). The effect grows with charge number \( Z \) leading even to decreasing binding \( B_{\Sigma^+} \) when going from \( Ca \) to \( Pb \). Consequently, only \( s \) and \( p \) bound states were found in \( \Sigma^+ \) hypernuclei for \( g_{\Sigma^+} = 0 \).

However, the \( \rho Y' \) coupling affects the previous results appreciably as can be seen also in Fig. 2 (solid line). The self consistent calculations\[20\] of the entire "core + hyperon" systems predict slightly attractive (and thus nonzero) \( \rho \) meson contribution even for hypernuclei with \( N = Z \) core (\( O, Ca \)). In \( Zr \) and \( Pb \) the \( \rho \) contribution is repulsive (attractive) for both \( \Sigma^- \), \( \Xi^- \) (\( \Sigma^+, \Xi^0 \)) and thus compensates to some extent the effect of the attractive (repulsive) Coulomb potential. In particular, the binding \( B_{\Sigma^+} \) converts from decreasing to an increasing function of \( A \) in the systems with a neutron excess. This result strongly depends on the value of the \( g_{\rho Y} \) coupling constant; in Ref. \[16\] where \( \alpha_{\Sigma^+} = 0.6 \) was used, no such conversion of the slope was observed.

The tensor coupling (9) is crucial for evaluating the hypernuclear spin orbit interaction. In Fig. 3, \( V_{\Sigma^+} \) (\( Y' = \Lambda, \Sigma^0, \Xi^0 \)) calculated using various tensor couplings \( \alpha_{\Sigma^+} \) from Table II serves as an example of quite different evolution of the spin orbit splitting for three kinds of hyperons. The \( \Lambda \) (\( \Xi \)) hypernuclear spin orbit splitting is gradually decreasing (increasing) due to a negative (positive) \( \alpha_{\Sigma^+} \). Extremely large negative values of \( \alpha_{\Sigma^+} \) result even in a change of the level ordering in \( \Xi \) hypernuclei. The above results become apparent from Schroedinger equivalent spin orbit potential\[48\]:

\[
V_{\Sigma^+} \vec{r} \cdot \vec{\tau} = \frac{1}{2M_{\Sigma^+}^2} \left[ \frac{1}{2}, (g_{\omega Y} V_0 - g_{\rho Y} \phi' + 2f_{\rho Y} M_{\Sigma^+}/M_Y) \right] \vec{r} \cdot \vec{\tau}, \quad M_{\Sigma^+} = M_Y - \frac{1}{2} (g_{\rho Y} V_0 - g_{\omega Y} \phi).
\]

For \( f_{\rho Y} = 0 \) the spin-orbit splitting \( \langle V_{\Sigma^+} \rangle \) for hyperons is reduced when compared to that one for nucleons due to a larger mass \( M_{\Sigma^+} \) in the denominator and due to the smaller couplings to \( \sigma \) and \( \omega \) mesons. The quark model values of the tensor coupling \( f_{\rho Y} \) for \( \Lambda, \Sigma \) and \( \Xi \) hyperons differ in their strengths and signs and hence their contribution to the spin-orbit term is different. This contribution is comparable in magnitude with the original \( \sigma - \omega \) part and is negative (positive) for \( \Lambda (\Sigma) \). It is negative and even larger than \( \sigma - \omega \) term for \( \Xi \). As a consequence, the spin orbit interaction for \( \Lambda \) nearly vanishes, it is almost doubled for \( \Sigma \), and changes sign for \( \Xi \).

It should be noted, however, that although the effects of tensor coupling are relatively large, the absolute shifts in energy levels amount to less than 1 MeV and this is still beyond the reach of contemporary experimental resolution\[41\].

**B. A hypernuclear currents and magnetic moments**

The relativistic and nonrelativistic models yield similar predictions for the isoscalar nuclear magnetic moments\[49\]. While the nonrelativistic (Schmidt) values are obtained directly in a single-particle approach, in the RMFT calculations the result comes from a compensation of two effects – the enhancement of the valence particle current due to the reduction of the effective nucleon mass and the contribution of the additional current from the polarized core\[50\]. This fundamental difference was expected to have a crucial consequence for \( \Lambda \) hypernuclei where the enhanced valence hyperon current was not entirely cancelled by core corrections due to different masses and couplings of \( \Lambda \) and \( N \).

The first self consistent calculations\[21, 22\] of hypernuclear currents and magnetic moments did not include the tensor coupling contribution (3). While Cohen and Furnstahl\[21\] evaluated the effect of the linear core response to the hyperon in the local density approximation, Mares and Zofka\[22\] made self consistent calculations of the entire "core + \( \Lambda \)" system and incorporated this effect automatically. Both calculations revealed remarkable differences between relativistic and Schmidt values.

The magnetic moments of several hypernuclei calculated in RMFT model L from Table I and parametrizations P1–P3 from Table II, with \( f_{\omega A} = 0 \) are presented in Table III. Since the \( \Lambda \) is a neutral particle the Schmidt value comes entirely from its anomalous moment. The deviations are then caused by nonvanishing contribution from polarized core. It is to be noted that the spatial components of the vector field \( \vec{V} \) are crucial here – when they are omitted the magnetic moments agree with the nonrelativistic predictions. The differences between RMFT and Schmidt values are proportional to the \( \alpha_{\omega A} \) and increase with \( A \)[22]. It should be stressed again that the above RMFT results were obtained when the anomalous \( \omega \Lambda \Lambda \) coupling was not included.

Introducing the tensor coupling term (3) into the Lagrangian (2) influences the predictions of the baryon currents and hypernuclear magnetic moments considerably\[23, 24\]. An excellent discussion with analytical derivations of the previous numerical results\[23\] was given by Cohen and Noble\[24\], so we limit ourselves to a brief statement of the conclusions. The vector current \( \vec{\Psi}_A \vec{\tau} \vec{\Psi}_A \) is modified due to the tensor coupling term by the additional contribution: \( \vec{\alpha}_{\omega A} \vec{\tau} \vec{V} \times (\vec{\Psi}_A \vec{\tau} \vec{\Psi}_A) \). The hypernuclear magnetic moment

\[
\vec{\mu}_{\omega A} = \frac{1}{2} \int d^4x \vec{\tau} \times \left( \vec{J}_\omega (\vec{r}) + \vec{J}_{\omega \Lambda} (\vec{r}) \right),
\]

has contributions from the hyperon and core electromagnetic currents (\( \vec{J}_\omega (\vec{r}) \) comes from the anomalous moment \( \mu_{\omega A} \)). The \( \Lambda \) contribution to the hypernuclear magnetic
A. ATTENTION-DEFICIT MODELING

Concerns about the cognitive deficits in ADD (Attention-Deficit Disorder) have centered on the idea that ADD is caused by a deficiency in the ability to pay attention to the present. The model states that people with ADD have a limited attention span and are easily distracted by external stimuli.

B. MULTITASKING SYSTEMS

Multitasking systems are designed to allow users to perform multiple tasks simultaneously. This can be achieved through the use of efficient information management techniques, such as task switching and task prioritization.

C. BRAINSCIENCE BASED METHODS

Brain science-based methods focus on understanding the brain's structure and function. This includes the development of tools and techniques that can be used to study the brain and its processes.

D. COMMUNICATION AND LEARNING

Communication and learning are essential for success in any field. Effective communication strategies can help students and professionals to better understand each other and to work together more effectively. Learning is the process of acquiring new knowledge, skills, and abilities. It is an essential part of personal and professional development.

E. MINDFULNESS AND MEDITATION

Mindfulness and meditation are practices that can help individuals to improve their concentration and focus. These practices involve paying attention to the present moment and letting go of judgment and distraction.

F. THE PRACTICE OF MEDITATION

The practice of meditation involves sitting in a comfortable position and focusing the mind on a single point of concentration, such as the breath or a word. This can help to calm the mind and reduce stress and anxiety.

G. THE ROLE OF MEDITATION IN LEARNING

Meditation has been shown to improve learning and memory in a number of studies. This is because it helps to reduce stress and improve attention and focus, which are essential for effective learning.
The optical potential for nucleons has been derived from the nucleon-nucleon t-matrix\cite{55} or determined by a fit\cite{56,57} to nucleon-nucleus scattering data over a wide range of energies and nuclei. In this work we have chosen as a starting point the latter approach. We adopted the strengths and shapes for the real and imaginary parts of the nucleon-nucleus scalar and vector potentials from the global optical model of Cooper et al.\cite{57}. For the real parts of the hyperon optical potential we assume the strengths scale like the nY Y (m=σ,ω and Y = Λ, Σ) couplings.

The scaling factors \(α_{Y}\) used in our calculations are listed in Table IV. Following the ideology of Section 2 we determined the first set (S1) of the scaling factors \(α_{ϕ}\), \(α_{Y} (Y = Λ, Σ)\) by searching for parametrization consistent with data on hyperon binding and simultaneously close to the SU(3) values. For the sake of comparison we made calculations of the Y-nucleus scattering observables also for values of \(α_{Y}\) close to 1/3. They are denoted as S2 in Table IV. The fits of the \(α_{Y}\) factors for real parts of the optical potentials were done using the geometry obtained from the global optical potential at 30 MeV\cite{57}.

We also include an anomalous coupling for the vector field with \(f = -g\) and \(f = +g\) for \(Λ\) and \(Σ\), respectively. The tensor coupling term directly affects the strength of the hyperon spin-orbit interaction and therefore influences the analyzing power \(A_p\). Since we limit our discussion to \(N = Z\) targets we do not include the isovector p meson which can in principle contribute to the \(Σ\) optical potential\cite{20}.

The imaginary part of the optical potential arises predominantly from processes where the projectile interacts twice with the nucleus. Therefore, we use for the imaginary part of the optical potential the square of the factor for the real part. This is admittedly crude but should serve as a first estimate. In fact, the imaginary part will be increased by a substantial contribution from \(ΣN \rightarrow ΛN\) conversion which was neglected here.

The \(α_{Y}\) values S1 from Table IV for potentials with optical model geometry and those from mean field calculations in Section 3 are close. It should be noted that this holds also for the other nuclei for which we obtained almost identical parametrization of the optical potential. This suggests that both the optical potential\cite{57} and mean field model have very similar radial forms. Moreover, this serves as a check of our approach since we are not far from where the couplings in Section 2 have been determined.

Calculations for the differential cross sections and analyzing powers\cite{30} were carried out using the modified code RUNT\cite{58}. Here we present only the results for \(Λ\) and \(Σ\) hyperon scattering off \(^{16}O\) at 200 MeV.

The comparison of the predictions of the parametrization S1 from Table IV for \(^{16}O\) and different types of projectiles at 200 MeV is made in Fig. 6. The cross sections are qualitatively similar, small deviations are caused by the different contribution of the Coulomb interaction and tensor coupling for each type of hyperon. The predictions of \(A_p\) differ considerably between \(Λ\) and \(Σ\) scattering while the difference between \(^{2}\Sigma^{*}\) and \(^{1}\Sigma^{*}\) is not so pronounced. This signals that \(A_p\) is affected far more by the tensor coupling than by the Coulomb interaction in this case. In order to confirm this observation we added in Fig. 6 the predictions for \(Λ\) with \(f/g = 0\), as well. The \(f/g = -1\) (value suggested by SU(3)) leads to a considerably smaller values of analyzing power – \(A_p\) is almost zero for forward angles. This result suggests that measurements of \(A_p\) would give information on tensor coupling of the vector meson to a hyperon.

Figure 7 illustrates the sensitivity of scattering observables to the strength of the hyperon coupling. The calculations were done for \(α_{Y} \approx 1/3\) (S2) which is close to values frequently used in the literature\cite{8,11,14,21}. The angular dependence of the cross section is more or less similar to that of Fig. 6 – the differences for all hyperons start to appear at larger angles where the cross section is more than 2 orders of magnitude lower than for forward angles. The apparent bump in the cross sections for \(^{2}\Sigma^{*}\) and corresponding sharp peak in \(A_p\) suggest a growing importance of the Coulomb interaction in this particular case. For \(Λ (f/g = -1)\) we obtained again very small \(A_p\). For the other values of tensor coupling (\(f/g = 0\) for \(Λ\) and \(f/g = -1\) for \(Σ\)) the \(A_p\) differs significantly from the predictions of Fig. 6, even for small angles. The measurement of the analyzing power for \(Σ\)-nucleus scattering might thus bring some information about the strength of the \(YN\) interaction. On the other hand the small spin-orbit force due to \(f = -g\) in the case of \(Λ\)-nucleus scattering means that we can not extract from \(A_p\) separate information about the scalar and vector potentials.

Calculations of Ref.\cite{30} revealed that the results tend to be sensitive to the choice of input parameters. However they are similar enough for qualitative conclusions. The differential cross sections show the typical diffractive shape. The different parameter sets predict relatively similar angular dependence – the magnitudes can differ by more than a factor of two particularly at large angles.

In the case of weak \(^{2}\Sigma^{*}\) hyperon couplings, the Coulomb interaction might cause some interference effects in the scattering observables. We observed strong sensitivity of \(A_p\) to the tensor coupling. The analyzing powers are small for the \(Λ (f/g = -1)\) but substantial for the \(Σ\)'s at energies around 200 MeV. Moreover, the predictions of \(A_p\) are quite sensitive to the strength of the \(Σ\) coupling. The measurement of \(A_p\) for \(Σ\)-nucleus scattering thus might become a source of information on \(YN\) interaction. However, it should be stressed again that \(ΣN \rightarrow ΛN\) conversion was neglected here. Its contribution to the imaginary part of the optical potential could significantly affect the calculated analyzing powers for \(Σ\). Therefore, this open problem deserves further study.

Currently there is no data on hyperon-nucleus scattering. However, this may change in the near future when an experiment at KEK may be able to provide data on \(^{2}\Sigma^{*}\)-nucleus\cite{31} scattering. The description of quasi-free hyperon production (\(γ, K^{+}Λ\)), an approved proposal at CERN\cite{59}, also requires knowledge of the hyperon-nucleus optical potential.

The present calculations should be regarded as a first attempt to obtain a qualitative estimate of the hyperon-nucleus scattering observables. It is clear that much work, both theoretical and experimental, still remains in this field.

**VI. NON-MESONIC DECAYS OF A HYPERNUCLEI**

The weak decay of the \(Λ\) and other hyperons has been studied for almost 40 years as an example of a non-leptonic weak process. In the absence of strong interaction
ACKNOWLEDGEMENTS

In this decade...

KoC, CeFr, DuNe - mitigate the broad perspectives of the hyperplane abscissa...

In conclusion...

(1) \[ \cos \alpha = \frac{x}{\sqrt{x^2 + y^2}} \]

(2) \[ N \rightarrow N/2 \]

(3) \[ A \rightarrow A + 1 \]

(4) \[ B \rightarrow B + 2 \]

(5) \[ C \rightarrow C + 3 \]

where $x$, $y$, and $z$ are the coordinates of the vector $\mathbf{v}$...
REFERENCES

A. Bouyssy, Phys. Lett. 90B (1981) 305;
Table III. Hypernuclear magnetic moments for $\Lambda$ in $s$ state calculated using model $L$, parametrizations P1-P3 from Table II and $f/g = 0$. For $f/g = -1$ the predicted values (between 0.611 and 0.613 n.m.) are close to the Schmidt value.

<table>
<thead>
<tr>
<th></th>
<th>$^{12}_A$C</th>
<th>$^{17}_A$O</th>
<th>$^{40}_A$Ca</th>
<th>$^{91}_A$Zr</th>
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<td></td>
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Table IV. The scaling factors $\alpha_V (i = S, V$ and $Y = \Lambda, \Sigma$) used in this work.

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<th>$f/g$</th>
<th>$\alpha_S$</th>
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<td>$\Sigma^-$</td>
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Figure 1. $^{16}_O$ 200 MeV – parametrization $S1$

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Figure 2. $^{16}_O$ 200 MeV – parametrization $S2$

Table V. Total decay rates for various hypernuclei (in units of free $\Gamma_A$)[33]. The experimental data are from Ref. [61].

<table>
<thead>
<tr>
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<th>$^{11}_A$B(5/2$^+$)</th>
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</thead>
<tbody>
<tr>
<td>No correlations</td>
<td>1.00</td>
<td>1.38</td>
<td>1.62</td>
</tr>
<tr>
<td>SRC, FF</td>
<td>0.25</td>
<td>0.30</td>
<td>0.35</td>
</tr>
<tr>
<td>SRC,FF,distortions</td>
<td>0.16</td>
<td>0.25</td>
<td>0.29</td>
</tr>
<tr>
<td>$\pi$ and $K$ exchange</td>
<td>0.22</td>
<td>0.36</td>
<td>0.41</td>
</tr>
<tr>
<td>exp.</td>
<td>0.41 ± 0.14</td>
<td>1.14 ± 0.20</td>
<td></td>
</tr>
</tbody>
</table>

Table VI. Asymmetry $\mathcal{A}$ at $\chi = 0^\circ$ for polarized $^{12}_A$C and $^{11}_A$B. The experimental data are from Ref. [62].

<table>
<thead>
<tr>
<th></th>
<th>$^{11}_A$B(5/2$^+$)</th>
<th>$^{12}_A$C(1$^-$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>exp.</td>
<td>-0.108</td>
<td>-0.047</td>
</tr>
</tbody>
</table>

$\mathcal{A}$ for $E/A$ in $^{14}_A$He and $^{40}_A$Ca for model $SH$ (Table I), parametrization P3 (Table II) and $f_{\Lambda_\Lambda}/g_{\Lambda_\Lambda} = -1$ compared with experimental data[41].

2. Comparison of the $\Sigma^-$ (upper part, a) and the $\Sigma^+$ (lower part, b) single particle levels for $\alpha_V = 0$ and $\alpha_S = 1$; $\alpha_T = 1$. 

3. Dependence of the hyperon single particle levels in $^{16}_O$ ($Y = \Lambda, \Sigma^+$, $\Sigma^-$) on the $\alpha_{TV} = f_{\Lambda_\Lambda}/g_{\Lambda_\Lambda}$ from Table II for a) $Y = \Lambda$, b) $Y = \Sigma^+$, c) $Y = \Sigma^-$. 

4. Dependence of the total ($R_T$ and $\Lambda (R_A)$) rms radii in $^{16}_O$ on the number of $\Lambda$ hyperons (n$_\Lambda$) for model $SH$ (Table I), parametrization P3 (Table II) and $f_{\Lambda_\Lambda}/g_{\Lambda_\Lambda} = 0, -1$. 

5. Evolution of the binding energy per particle ($E/A$) in $^{14}_A$He and $^{40}_A$Ca for model $SH$ (Table I), parametrization P3 (Table II) and $f_{\Lambda_\Lambda}/g_{\Lambda_\Lambda} = -1$.

6. The observables predicted for 200 MeV $\Lambda$ (solid line for $f/g = 0$, long dash for $f/g = -1$), $\Sigma^+$ (dash-dotted line) and $\Sigma^-$ (dotted line) elastically scattered from $^{16}_O$. The used parametrization is close to SU(3) and is given in Table IV.

7. The observables predicted for 200 MeV hyperons elastically scattered from $^{16}_O$ for parametrization close to 1/3 from Table IV. Notation is that of Fig. 6.