Neutron to proton mass difference, parton distribution functions and baryon resonances from dynamics on the Lie group u(3)

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Neutron to proton mass difference, parton distribution functions and baryon resonances from dynamics on the Lie group u(3)

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Abstract
We present a hamiltonian structure on the Lie group u(3) to describe the baryon spectrum. The ground state is identified with the proton. From this single fit we calculate approximately the relative neutron to proton mass shift to within half a percentage of the experimental value. From the same fit we calculate the nucleon and delta resonance spectrum. For specific spin eigenfunctions we calculate the delta to nucleon mass ratio to within one percent.

The allospatial hypothesis
The Schrödinger equation describes the baryon spectrum with a periodic potential and reduced zone scheme where we identify as the eigenvalues of the Hamiltonian.

The theory unfolded
The Laplacian in (1) is a representation of the Lie group u(3) that is parameterized by the exterior derivative. In particular, the potential is given by the geodetic distance from the 'point' to the 'origo'. The potential is half the squared geodetic distance from the 'point' to any point in the group. This interpretation is supported by their commutation relations as body fixed angular momentum. The relation between space and algebra is like the relation in number theory between algebraic number fields and rings of algebraic integers. For the description of rotational degrees of freedom. The remaining three are grouped into N, V, λ, which is related to hypercharge and isospin. They can be interpreted as the components of the group u(3) at a single point.

Conclusions
The allospatial Hamiltonian in (1) or (3) may be seen as an effective phenomenology or interpreted more radically in a conceptual interpretation where we see it as the impact momentum as introtangling operators generate the maximal torus of u(3). An approximate solution to the Schrödinger equation is obtained by mapping the baryonic spectrum to a spectrum of eigenstates of the form where θ and ϕ are the trigonometric functions constructed from the generators. The result is a Hamiltonian structure on the Lie group u(3).

References
See also: C. L. Trinhhammer, Baryons from quantum mechanics on the Lie group u(3) at 68.07E (Dec 81).

Acknowledgments
Tobias Afzelius, Jakob Bide, Malte Hammerich, Hans Bror Nielsen, Hanne Bent Nielsen, Hanne Bent Nielsen, Mads Hammerich, Peter Strobosch, Sven Bjørnholm and Bo-Sture Skagerstam for key comments.

Parton distributions
We project from a state constructed from trigonometric functions to mimicking the periodic doubling implied in the decay to the proton state.

![Diagram of parton distributions](image)


Acknowledgments
The authors gratefully acknowledge helpful discussions with J. M. C. M. (Odebrecht) and P. S. (Goldhaber), and the use of the computer code.

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