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The Generalized Gell-Mann–Okubo Formalism

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The original Gell-Mann–Okubo (GMO) formalism treats the light baryons as objects to be seen in light of the broken $SU(3)$ symmetries of the three light quarks, and lead to the development of the famous Eightfold Way diagrams. In particular, each baryon mass group (N , Δ , Σ , Σ^* , Ξ , Ξ^* , Ω) form isospin multiplets who differ in strangeness values. With the advent of the quark model, baryons are now treated as objects to be seen in light of very badly broken $SU(6)$ symmetries of the six quarks. This requires visualizing baryons in a six-dimensional flavour space. While this is not a mathematical impediment in itself, the intuitiveness and the visual appeal of the GMO approach is lost.

However, the GMO formalism can be extended with the introduction of the concepts of generalized isospin and generalized mass groups. This allows to view any baryon in light of a broken $SU(3)$ symmetry of its constituent quarks. Eightfold Way diagrams can be obtain for these baryons, and a modified Gell-Mann–Okubo mass formula will reproduce (and predict) the mass of nearly all observed (and yet-to-be-observed) baryons within 50 MeV, on mass scales that span anywhere from 1000 MeV to 15000 MeV.

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