– For the pseudoscalar mesons

particles	$S_{\text{strangeness}}$	Mass (MeV)	Q	I	I_3	$\psi_{flavour}$
K^0, K^+	1	496	0,+1	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	$d\bar{s}$, $u\bar{s}$
π^-, π^0, π^+	0	138	-1,0,+1	1	-1,0,+1	$d\bar{u}$, $\frac{1}{\sqrt{2}}(u\bar{u} - d\bar{d})$, $u\bar{d}$
η	0	776	0	0	0	$\frac{1}{\sqrt{6}}(u\bar{u} + d\bar{d} - 2s\bar{s})$
η'	0	957	0	0	0	$\frac{1}{\sqrt{3}}(u\bar{u} + d\bar{d} + s\bar{s})$
K^-, $\overline{K}^0$	-1	496	-1,0	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	$s\bar{u}$, $s\bar{d}$

– $K^+, K^0, \overline{K}^0, K^-, \pi^+, \pi^0, \pi^-\eta$ are the octet and η' is the singlet

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π^-, π^0, π^+	0	138	-1,0,+1	1	-1,0,+1	$d\bar{u}$, $\frac{1}{\sqrt{2}}(u\bar{u} - d\bar{d})$, $u\bar{d}$
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– $K^+, K^0, \overline{K}^0, K^-, \pi^+, \pi^0, \pi^-\eta$ are the octet and η' is the singlet

– For the vector mesons

Particles	S	Mass(MeV)	Q	I	I_3	$\psi_{flavour}$
K^{*0}, K^{*+}	1	896	0, +1	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	$d\bar{s}$, $u\bar{s}$
ρ^-, ρ^0, ρ^+	0	776	-1,0,+1	1	-1,0,+1	$d\bar{u}$, $\frac{1}{\sqrt{2}}(u\bar{u} - d\bar{d})$, $u\bar{d}$
ω	0	783	0	0	0	$\frac{1}{\sqrt{2}}(u\bar{u} + d\bar{d})$
ϕ	0	1020	0	0	0	$s\bar{s}$
K^{*-}, $\overline{K}^{*0}$	-1	896	-1,0	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	$s\bar{u}$, $s\bar{d}$

– $K^{*+}, K^{*0}, \overline{K}^{*0}, K^{*-}, \rho^+, \rho^0, \rho^-$ are 7 members of the octet

– ω and ϕ are an admixture of the singlet and the neutral component of the octet.

Mass formula for the mass of a meson compose of a quark 1 and and antiquark 2 as

$$\text{M(meson)} = m_1 + m_2 + A\,\frac{\langle \vec{S}_1.\vec{S}_2\rangle}{m_1\,m_2}$$

with

$$\langle \vec{S}_1.\vec{S}_2\rangle = \frac{s(s+1)}{2} - \frac{3}{4} = \begin{cases} -\frac{3}{4} \text{ for pseudoscalar mesons (s = 0)} \\ \frac{1}{4} \text{ for vector mesons (s = 1)} \end{cases}$$

For the values $m_u = m_d = 310$ MeV $m_s = 483$ MeV and $A = (2m_u)^2 \times 160$ MeV

Meson	Calculated	Observed
π	140	138
K	484	496
η	559	549
ρ	780	776
ω	780	783
K^*	896	892
ϕ	1032	1020

So this model could explain the masses of all the light meson (except the η') to about 1% accuracy.

– Baryons with Spin $s = \frac{1}{2}$: 8 particles

particles	S	Mass (MeV)	Q	I	I_3	quark content
n, p	0	939	0,+1	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	udd, uud
$\Sigma^-, \Sigma^0, \Sigma^+$	-1	1193	-1,0,+1	1	-1,0,+1	dds, uds, uus
Λ^0	-1	1114	0	0	0	uds
Ξ^-, Ξ^0	-2	1318	-1,0	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	dss, uss

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Λ^0	-1	1114	0	0	0	uds
Ξ^-, Ξ^0	-2	1318	-1,0	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	dss, uss

– Baryons with Spin $s = \frac{3}{2}$: 10 particles

particles	S	Mass (MeV)	Q	I	I_3	quark content
Δ^-,Δ^0,Δ^+,Δ^{++}	0	1232	-1,0,+1,+2	$\frac{3}{2}$	$-\frac{3}{2}, -\frac{1}{2}, +\frac{1}{2}, +\frac{3}{2}$	ddd udd, uud, uuu
$\Sigma^{*-}, \Sigma^{*0}, \Sigma^{*+}$	-1	1384	-1,0,+1	1	-1,0,+1	dds,uds, uus
Ξ^{*-}, Ξ^{*0}	-2	1533	-1,0	$\frac{1}{2}$	$-\frac{1}{2}, +\frac{1}{2}$	dss, uss
Ω^-	-3	1672	-1	0	0	sss

Again, the masses of all baryons in a given multiplet are not all the same because the $SU(3)_{\text{flavour}}$ symmetry is broken by the different quark masses.

But they are more similar within each multiplet so the potential between the quarks must be spin dependent.

$$\mathrm{M(baryon)} = m_1 + m_2 + m_2 + A' \left(\frac{\langle \vec{S}_1 . \vec{S}_2 \rangle}{m_1\, m_2} + \frac{\langle \vec{S}_1 . \vec{S}_3 \rangle}{m_1\, m_3} + \frac{\langle \vec{S}_2 . \vec{S}_3 \rangle}{m_2\, m_3} \right)$$

For the baryon decuplet in all spin configurations one finds

$$\langle \vec{S}_i . \vec{S}_j \rangle = \frac{1}{4}$$

The mass of all baryons in the decouplet can well explained with $A' = (2m_u)^2\, 50$ MeV.

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