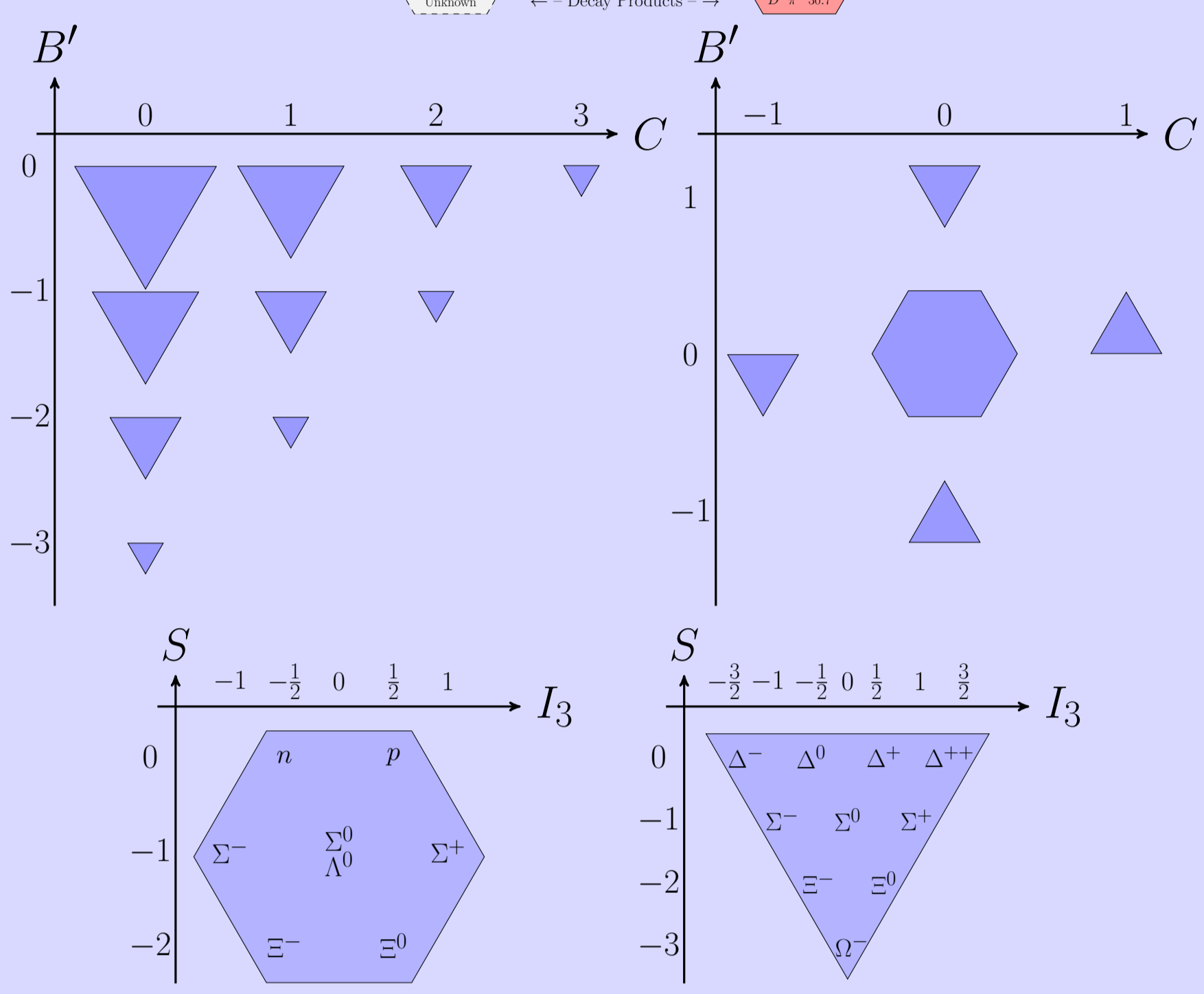
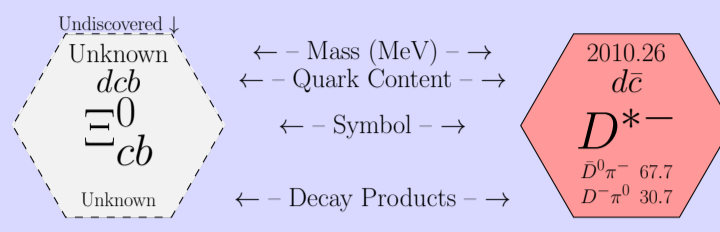
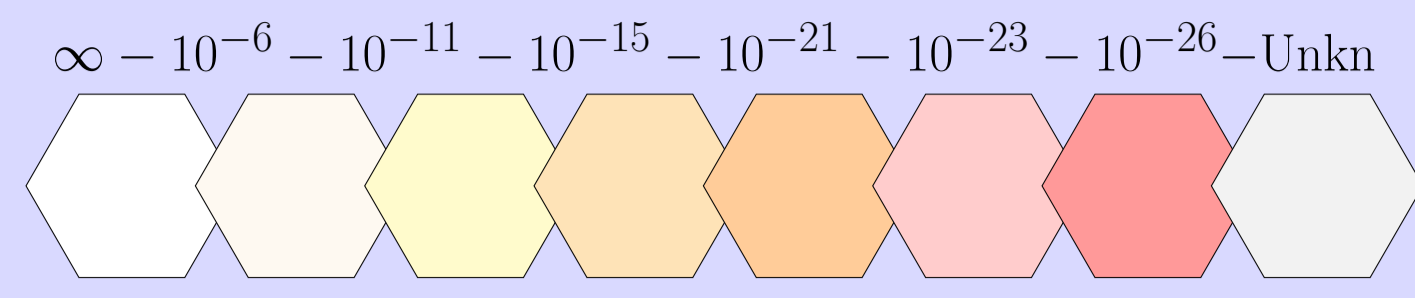
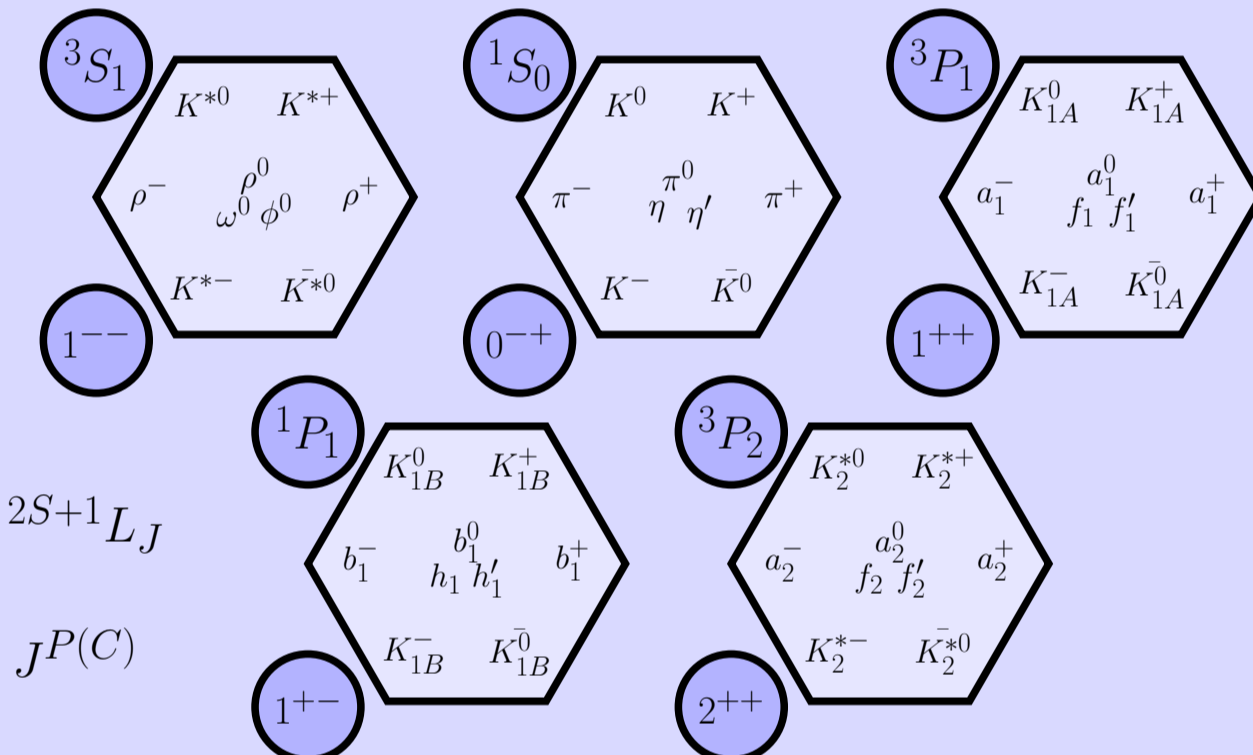


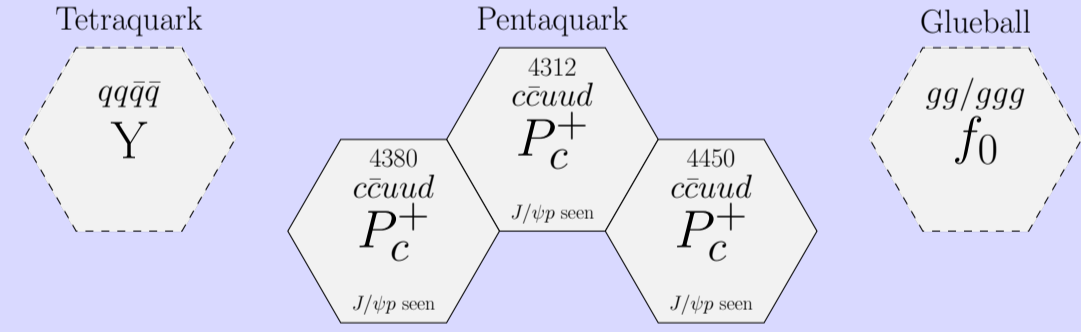
Table of Hadrons



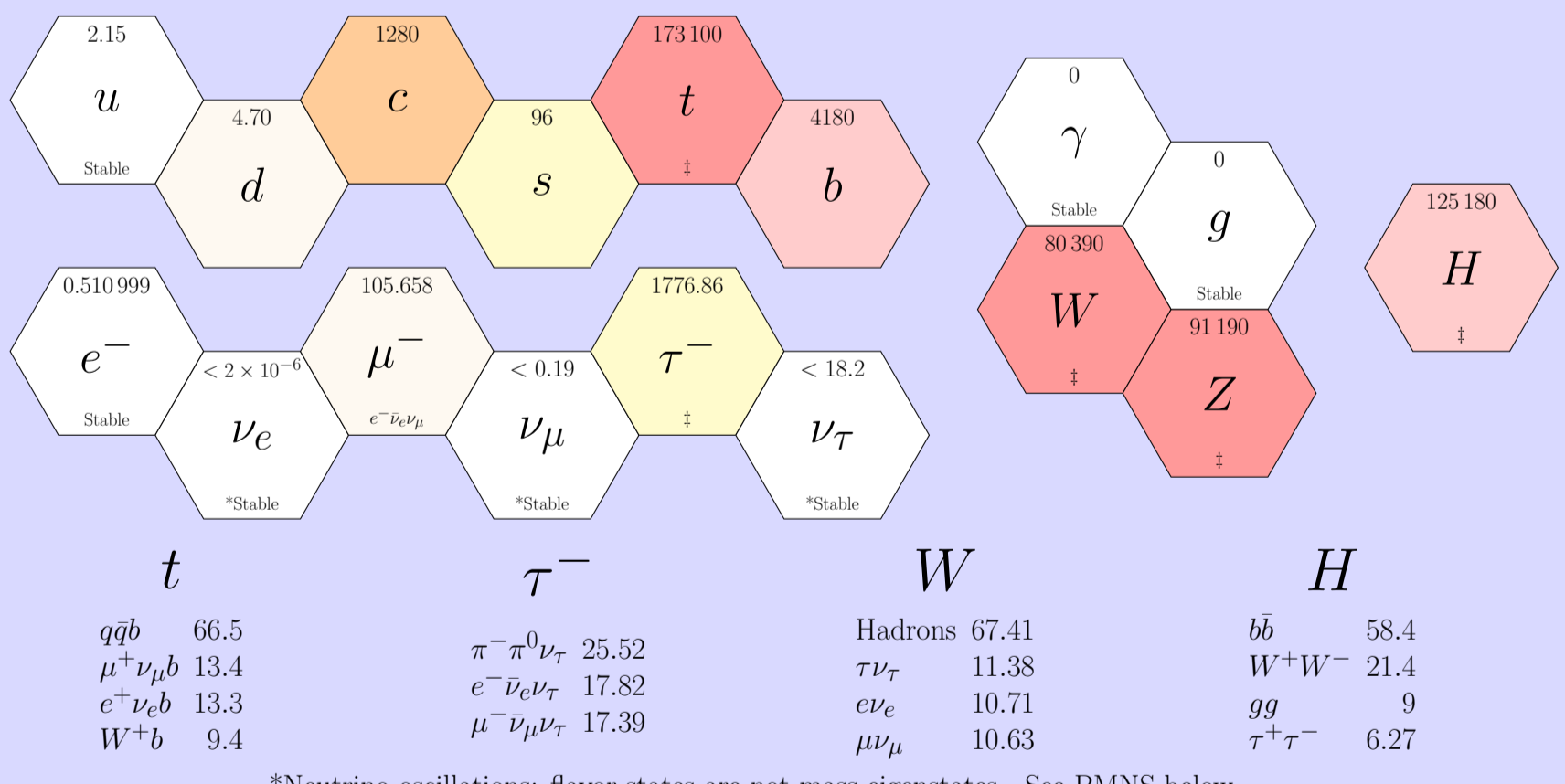
Higher Angular Momentum States



Exotic Hadrons



Standard Model



Flavor Mixing Matrices

$$V = \begin{bmatrix} 1 & 0 & 0 \\ 0 & c_{23} & s_{23} \\ 0 & -s_{23} & c_{23} \end{bmatrix} \begin{bmatrix} c_{13} & 0 & s_{13}e^{i\delta} \\ 0 & 1 & 0 \\ -s_{13}e^{-i\delta} & 0 & c_{13} \end{bmatrix} \begin{bmatrix} c_{12} & s_{12} & 0 \\ -s_{12} & c_{12} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$c_{ij} = \cos \theta_{ij}$, $s_{ij} = \sin \theta_{ij}$

Cabibbo-Kobayashi-Maskawa (CKM) Matrix

$$\begin{bmatrix} |V_{ud}| & |V_{us}| & |V_{ub}| \\ |V_{cd}| & |V_{cs}| & |V_{cb}| \\ |V_{td}| & |V_{ts}| & |V_{tb}| \end{bmatrix} = \begin{bmatrix} 0.97427 & 0.22534 & 0.00351 \\ 0.22520 & 0.97344 & 0.0412 \\ 0.00867 & 0.0404 & 0.999146 \end{bmatrix}$$

Pontecorvo-Maki-Nakagawa-Sakata (PMNS) Matrix

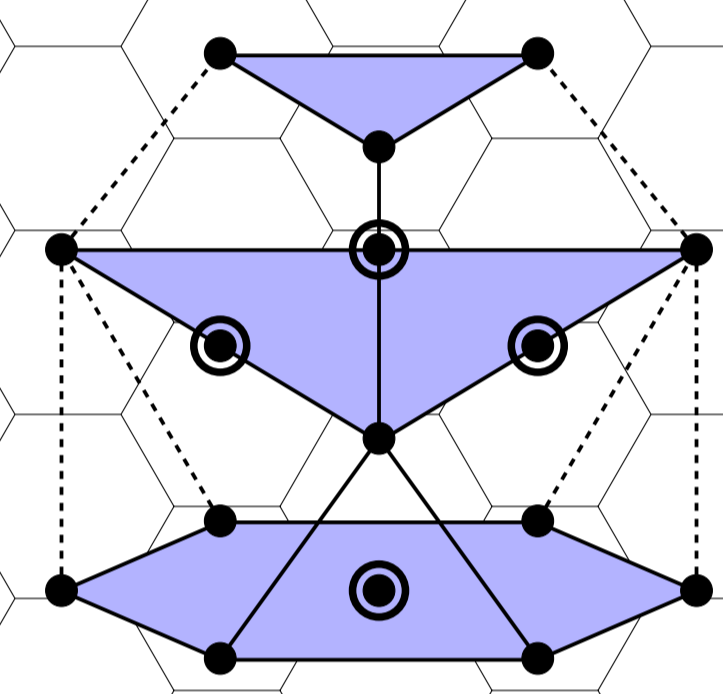
$$\begin{bmatrix} |U_{e1}| & |U_{e2}| & |U_{e3}| \\ |U_{\mu 1}| & |U_{\mu 2}| & |U_{\mu 3}| \\ |U_{\tau 1}| & |U_{\tau 2}| & |U_{\tau 3}| \end{bmatrix} = \begin{bmatrix} 0.822 & 0.549 & 0.149 \\ 0.368 & 0.523 & 0.707 \\ 0.403 & 0.593 & 0.685 \end{bmatrix}$$

Values consistent with current publications and Particle Data Group as of September 2019.

Genessa Benton
 Kitran Colwell Ph.D.
 Derek DeRouen

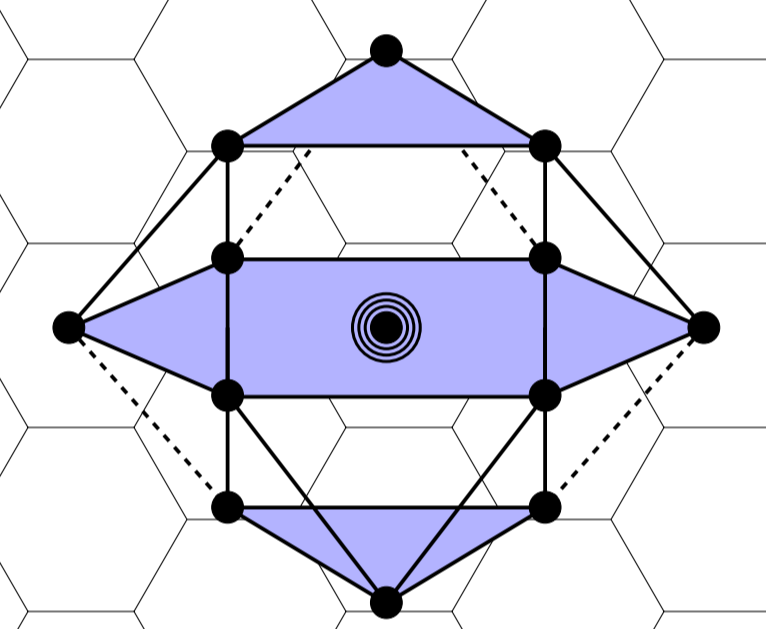
Baryon Octet

$$J^P = \frac{1}{2}^+$$



Pseudoscalar Mesons

$$J^P(C) = 0^- (+)$$



π^0	η	η'
$\frac{1}{\sqrt{2}}(uu - dd)$	$\psi_8 = \frac{1}{\sqrt{6}}(uu + dd - 2s)$	$\psi_1 = \frac{1}{\sqrt{3}}(uu + dd + ss)$
2γ 98.82	2γ 39.41	$\pi^+\pi^-\eta$ 42.6
$e^+e^-\gamma$ 1.17	$3\pi^0$ 32.68	$\rho^0\gamma, \pi^+\pi^-\gamma$ 28.9
	$\pi^+\pi^-\pi^0$ 22.92	$2\pi^0\eta$ 22.8
	$\pi^+\pi^-\gamma$ 4.22	

$$\begin{pmatrix} \eta \\ \eta' \end{pmatrix} = \begin{pmatrix} \cos \theta_P & -\sin \theta_P \\ \sin \theta_P & \cos \theta_P \end{pmatrix} \begin{pmatrix} \psi_8 \\ \psi_1 \end{pmatrix} = \begin{pmatrix} \cos \alpha_P & -\sin \alpha_P \\ \sin \alpha_P & \cos \alpha_P \end{pmatrix} \begin{pmatrix} \psi_8 \\ \psi_1 \end{pmatrix}$$

$\theta_P = -14.1 \pm 2.8^\circ$, $\alpha_P = \theta_P + \tan^{-1} \sqrt{2} = 40.6 \pm 2.8^\circ$

K^+	K^-	K_S	K_L
$u\bar{s}$	$s\bar{u}$	$\frac{1}{\sqrt{2}}(K^0 - \bar{K}^0)$	$\frac{1}{\sqrt{2}}(K^0 + \bar{K}^0)$
$\mu^+\nu_\mu$ 63.56	$\mu^-\nu_\mu$ 63.56	$\pi^+\pi^-$ 69.20	$\pi e \nu_e$ 40.55
$\pi^+\pi^0$ 20.67	$\pi^-\pi^0$ 20.67	$2\pi^0$ 30.69	$\pi\mu\nu_\mu$ 27.04
$2\pi^+\pi^-$ 5.583	$2\pi^-\pi^+$ 5.583	$3\pi^0$ 19.52	
$\pi^0 e^+ \nu_e$ 5.07	$\pi^0 e^- \nu_e$ 5.07	$\pi^+\pi^-\pi^0$ 12.54	

ρ^0	ϕ	ω
$\frac{1}{\sqrt{2}}(uu - dd)$	$\psi_8 = s\bar{s}$	$\psi_1 = \frac{1}{\sqrt{3}}(uu + dd)$
$\pi^+\pi^-$ 100	K^+K^- 49.2	$\pi^+\pi^-\pi^0$ 89.2
	$K_S^0 K_L^0$ 34.0	$\pi^0\gamma$ 8.40
	$\rho^+\pi^-\pi^0$ 15.2	

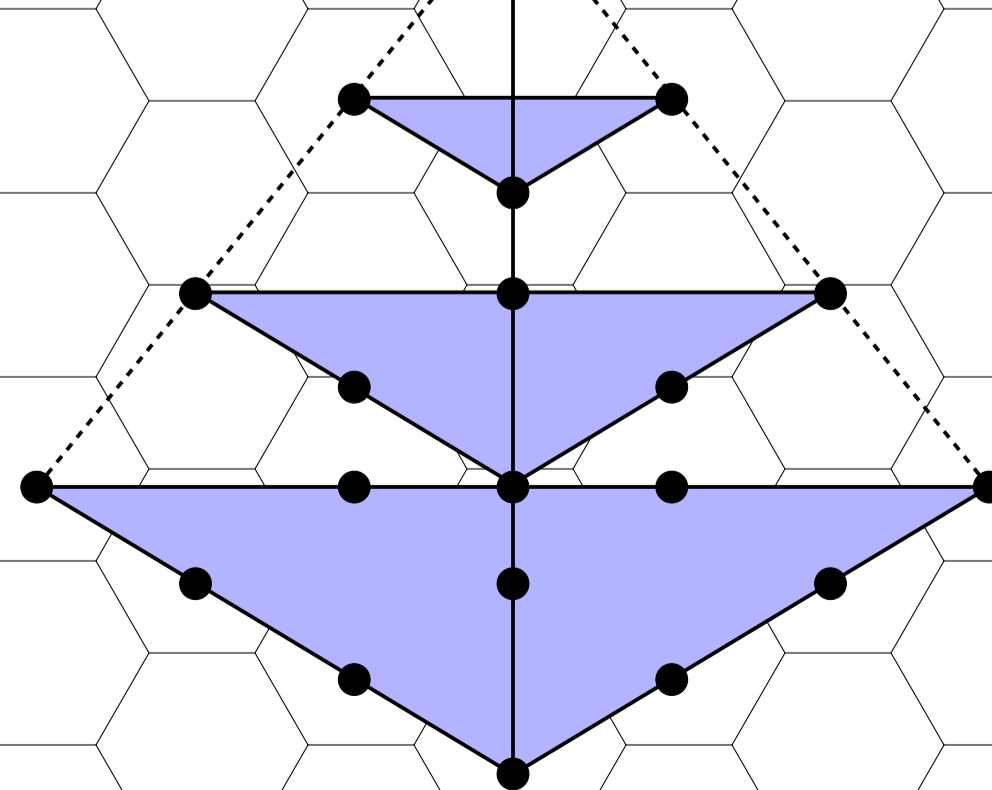
$$\begin{pmatrix} \phi \\ \omega \end{pmatrix} = \begin{pmatrix} \cos \theta_V & -\sin \theta_V \\ \sin \theta_V & \cos \theta_V \end{pmatrix} \begin{pmatrix} \psi_8 \\ \psi_1 \end{pmatrix} = \begin{pmatrix} \cos \alpha_V & -\sin \alpha_V \\ \sin \alpha_V & \cos \alpha_V \end{pmatrix} \begin{pmatrix} \psi_8 \\ \psi_1 \end{pmatrix}$$

$\theta_V = 36.4^\circ$, $\alpha_V = \theta_V + \tan^{-1} \sqrt{2} = 91.1^\circ$

J/ψ	Υ
$c\bar{c}$	$b\bar{b}$
Hadrons 87.7	Hadrons 86.8
e^+e^- 5.97	$\tau^+\tau^-$ 2.60
$\mu^+\mu^-$ 5.96	$\mu^+\mu^-$ 2.48
	e^+e^- 2.38

Baryon Decuplet

$$J^P = \frac{3}{2}^+$$



Vector Mesons

$$J^P(C) = 1^- (-)$$

