Predictions from spontaneously broken flavor symmetries

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Based on:
M.-C. Chen, M. Fallbacher, M. Ratz, C. S., [hep-ph/1208.2947]

Supersymmetric flavor models

- Fermion masses and mixing patterns can arise from discrete flavor symmetries (e.g. $\mathrm{A}_4, \mathrm{T}', \ldots$), have to introduce ‘flavon’ fields.
- Superpotential at leading order,

$$\mathscr{W}_{\text{leading}} = \frac{1}{\Lambda}(\Phi_e)_{gf}\, L^g\, E^f\, H_d + \frac{1}{\Lambda^2}(\Phi_\nu)_{gf}\, L^g\, H_u\, L^f\, H_u\ .$$

- Break flavor group by flavons acquiring VEVs, this leads to certain mixing patterns, e.g. tri–bi–maximal mixing.

Effective superpotential

$$\mathscr{W}_{\text{eff}} = (Y_e)_{gf}\, L^g\, E^f\, H_d + \frac{1}{4}\kappa_{gf}\, L^g\, H_u\, L^f\, H_u\ .$$

Corrections from the Kähler potential

- When including all terms consistent with flavor symmetry, the Kähler potential reads

$$K \;=\; K_{\mathrm{canonical}} + \Delta K = \sum_f \left[\left(L^f\right)^\dagger L^f + \left(E^f\right)^\dagger E^f\right] + \Delta K\;.$$

Corrections from the Kähler potential

$\Delta\, K \supset (L\,\Phi)^\dagger\,(L\,\Phi)$ cannot be forbidden by a (conventional) symmetry.

- After VEV insertion, this leads to $K \;=\; L^\dagger\,(1-2\,x\,P\,)\,L$, with e.g. P–matrix from an A_4 model

$$P \;\sim\; \begin{pmatrix} 0 & \mathrm{i} & -\mathrm{i} \\ -\mathrm{i} & 0 & \mathrm{i} \\ \mathrm{i} & -\mathrm{i} & 0 \end{pmatrix}\;.$$

Result and conclusions

- Analytic formulae for the change in mixing angles
  $\Delta\theta_{13} \;=\; \kappa\frac{v^2}{\Lambda^2}3\sqrt{6}\frac{m_1}{m_1+m_3}$:

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