$N \times N$ Mixing Matrices for Quarks and Leptons
and
Möbius Transformations for Direct CP Violations

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I show a versatile construction procedure for $N \times N$ Cabibbo-Kobayashi-Maskawa (CKM) matrices for quarks, Pontecorvo-Maki-Nakagawa-Sakata (PMNS) matrices for leptons, and general unitary matrices [1]. The construction procedure clarifies the 3×3 case, which was given by Chau and Keung in 1984 [2] and has been adopted by the Particle Data Group as the standard parametrization, and is useful for the beyond.

I formulate expressions for amplitudes suitable for quantifying both modulus and phase direct CP violations [1]. They result in Möbius transformation (MT) relations, which provide encouraging information for the search of direct CP violations in general. I apply the formulation to calculate the phase and the modulus direct CP violations and the strong amplitudes in the $B^{\mp}$ two-body decays that resulted in $B^{\mp} \rightarrow K^{\mp} \pi^{\pm} \pi^{\mp}$ as measured by the Belle collaboration.

[1] L.-L. Chau, Phys. Lett. B651 (2007) 293.
http://www.physics.ucdavis.edu/~chau/Chau-Direct-CP-PLb651-p293.pdf
[2] L.-L. Chau and W.-Y. Keung, Phys. Rev. Lett. 53 (1984) 1802.
http://www.physics.ucdavis.edu/~chau/Chau-Keung-paraKM-PRL53-p1802-1984.pdf