

Comparison of fit models

A theory perspective

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+/- list for the various fit models

- ▷ comparing the three fit models that incorporate knowledge about the analytic structure of the non-local matrix elements
- ▷ from theory point of view: what are objective pros / contras of each fit model?

+/- list for the various fit models

Analyticity

dispersion relations

[Khodjamirian et al. '10 and '12]

- ▷ analyticity is a built-in property
- ▷ numerically relevant poles and branch cuts present

z expansion

[Bobeth et al. '17]

- ▷ analytic by construction
- ▷ numerically relevant poles and branch cuts present

empirical model

[Blake et al. '17]

- ▷ no analytic continuation of resonance widths below the relevant thresholds (e.g. $\text{Re } \Gamma(J/\psi) \rightarrow 0$ for $q^2 \leq 4M_\pi^2$)
- ▷ violates unitarity; but can be restored through isobar-like relative phases between resonance terms

+/- list for the various fit models

property	disp. rel.	z exp.	emp. model
analyticity	✓	✓	—
applicable region	$q^2 < 4M_D^2$	$q^2 < 4M_D^2$	$4M_\pi^2 < q^2$

+/- list for the various fit models

of theory inputs

dispersion relations

[Khodjamirian et al. '10 and '12]

- ▷ as is: **one** theory input built in at small $q^2 \ll 4m_c^2$; no shape info used
- ▷ w/ mod.: can be used to fit to **arbitrary many** theory inputs

z expansion

[Bobeth et al. '17]

- ▷ can accommodate **arbitrary many** theory inputs
respects shape information
- ▷ practical limit imposed only by theory correlations (regularity of covariance matrix)

empirical model

[Blake et al. '17]

- ▷ cannot use theory inputs at $q^2 < 4M_\pi^2$ due to lack of analytic continuation
- ▷ accommodates **arbitrary number** of theory inputs for $\simeq 1\text{GeV}^2 \leq q^2 \ll 4m_c^2$ 1/1

+/- list for the various fit models

property	disp. rel.	z exp.	emp. model
analyticity	✓	✓	-
applicable region	$q^2 < 4M_D^2$	$q^2 < 4M_D^2$	$4M_\pi^2 < q^2$
# of th. inputs ($q^2 < 0$)	w/ mod.: no limit	no limit	none
# of th. inputs ($q^2 \geq 0$)	w/ mod.: no limit	no limit	no limit
shape of theory pred.	w/ mod.: ✓	✓	$q^2 > 0$: ✓