

# Discrepancies in $e^+e^-$ data in the context of the BMW20 result

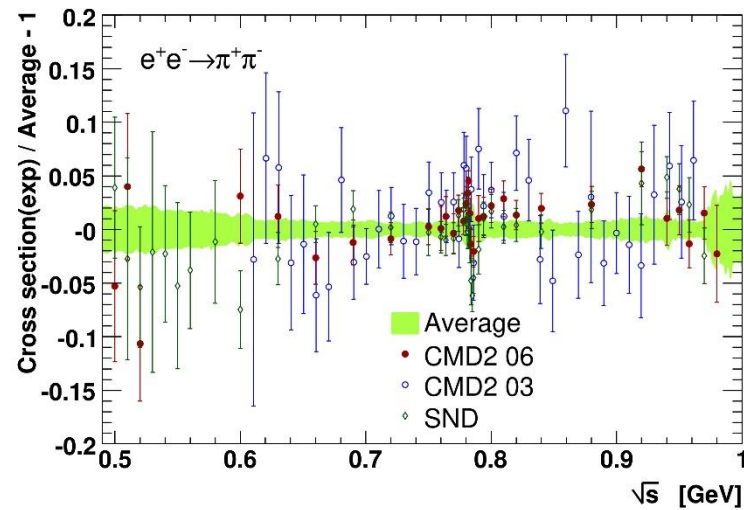
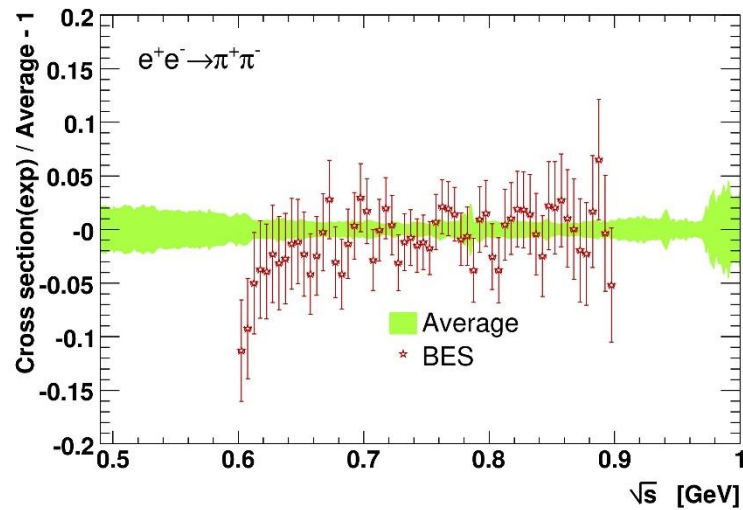
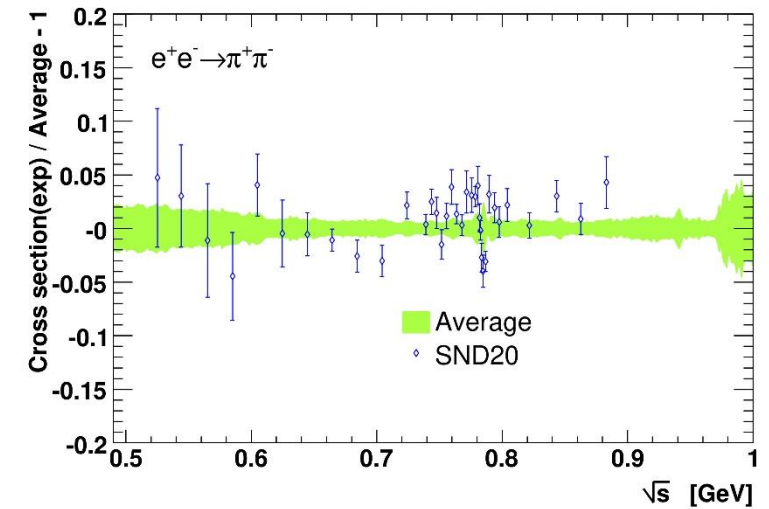
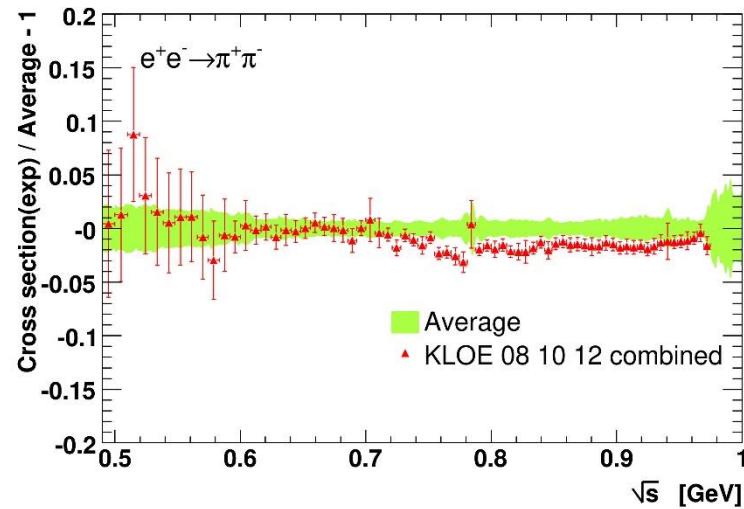
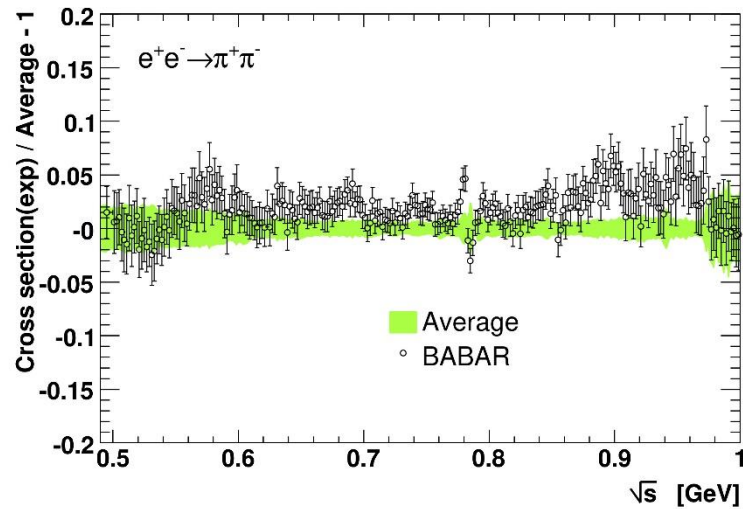
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- Disagreement BMW20 lattice vs. data-based dispersive results (2.1%)
- Raises the issue of potential biases in the  $e^+e^-$  input data, localized in low-energy range, typically  $< 1$  GeV
- Latest dispersive evaluations rely on a rather complete set of measurements of  $e^+e^- \rightarrow$  hadrons up to  $6\pi$ ,  $\eta 4\pi$ ,  $KK2\pi$  in all charge configurations, and a few more higher-multiplicity processes
- missing channels in the range  $[1.5-1.8]$  GeV are estimated to contribute  $< 0.03\%$  using isospin symmetry
- discrepancies exist in the  $K^+K^-$  channel on the  $\phi(1020)$  (CMD-3 vs. CMD-2, SND, BABAR), taken into account in the combination
- Region  $< 1$  GeV dominated by  $\pi^+\pi^-$  channel where discrepancies are observed between the 2 most precise measurements BABAR and KLOE
- Taking into account the BABAR/KLOE disagreement in the combination, all experiments are in agreement within an enlarged combination uncertainty (0.7%), already a remarkable result given different experimental conditions: ISR (10.6 GeV BABAR,  $\sim 4$  GeV BES CLEOc, 1.02 GeV KLOE), direct scan (CMD-2, SND)
- Briefly review the  $\pi^+\pi^-$  situation with respect to the BMW20 result

\* Work done with Andreas Höcker, Bogdan Malaescu, Zhiqing Zhang (DHMZ)

# Comparing measured cross sections to latest DHMZ combination

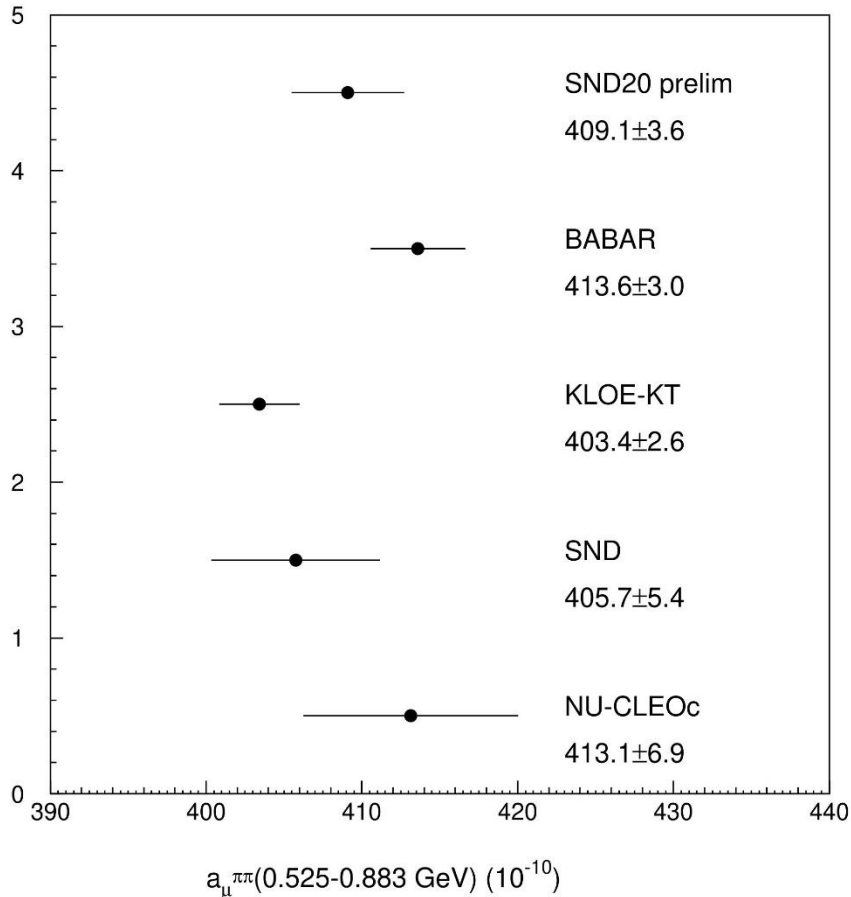
- Only one new piece of data (SND20) since DHMZ19, still preliminary
- Display cross sections ratio to new combination including SND20 (green band)



- Combination weighted toward KLOE (smaller quoted uncertainty)
- SND20 shows same trend/KLOE as BABAR > 0.7 GeV
- Small excess in BABAR/SND20 0.65 - 0.7 GeV

# Comparing $a_\mu [\pi^+\pi^-]$ integrals in $\rho$ peak region

- Not a direct test of data compatibility because of potential compensating local differences, if not understood
- Choose full range of SND20 [0.525-0.883] GeV to compare to other experiments covering this range



- BABAR consistent with all other experiments except KLOE

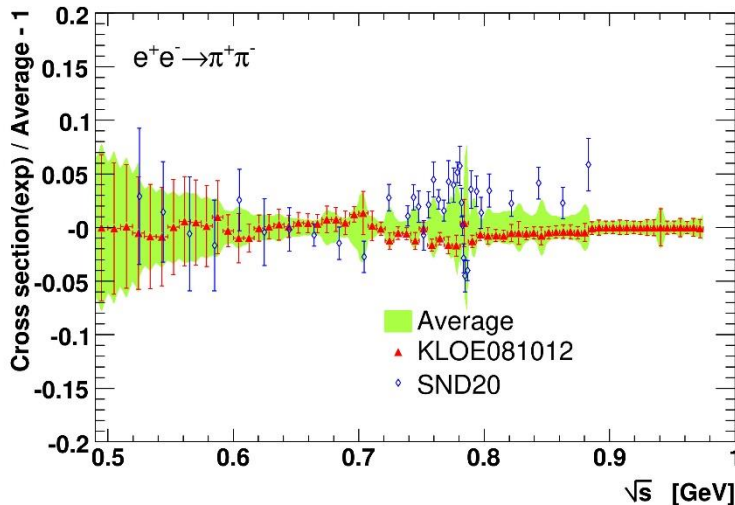
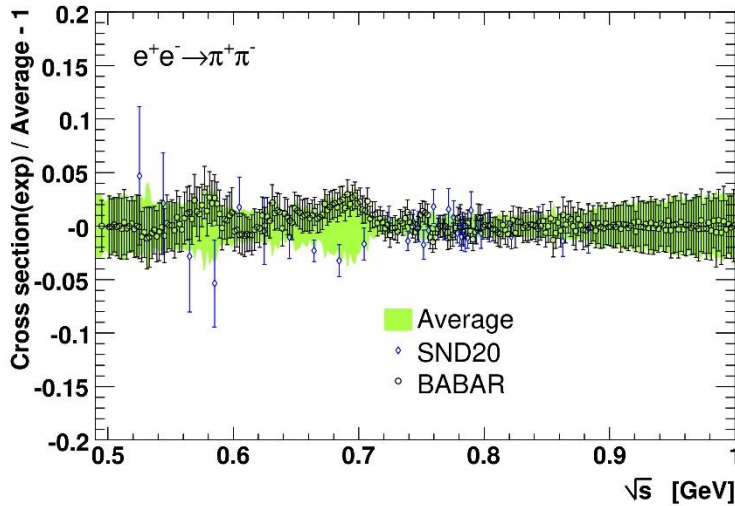
$$\chi^2 = 2.4/3 \text{ DF}$$

- KLOE consistent with all other experiments except BABAR

$$\chi^2 = 2.9/3 \text{ DF}$$

- Situation unchanged since DHMZ19 and WP
- Need new more precise data to confirm/dismiss present trend
- Waiting for CMD-3 results (near term?) and new independent BABAR analysis (longer term)

# Quantifying level of discrepancy in data in view of BMW20 result



- Comparing  $10^{10} \times a_\mu^{\text{LO had}}$  results:

BMW20	$708.7 \pm 2.8 \pm 4.5$ (5.3)	0.75%	--
DHMZ19 all	$694.0 \pm 1.0 \pm 2.5 \pm 0.7 \pm 2.8$ (4.0)	0.58%	2.2 $\sigma$
	stat syst QCD BABAR-KLOE		
DHMZ19 –KLOE	$696.8 \pm (3.1)$	0.44%	1.9 $\sigma$
DHMZ19 –BABAR	$691.2 \pm (3.1)$	0.44%	2.9 $\sigma$
WP20 all	$693.1 \pm 2.8 \pm 0.7 \pm 2.8$ (4.0)	0.58%	2.3 $\sigma$
	exp QCD BABAR-KLOE		

- BABAR/KLOE discrepancy results in a 30% loss in precision
- But does not account for the difference with BMW20
- However difference reduced for BABAR compared to KLOE

- Taking SND20 as referee
- Small discrepancy 0.65 - 0.7 GeV BABAR
- Large discrepancy > 0.7 GeV KLOE