

## COLLABORATION AGREEMENT

### IN2P3 - COPIN

#### I. Identification of the laboratories

Partner	COPIN
IN2P3 laboratories	IJCLab
Partner laboratories	Cracovie (IFJ PAN)

#### II. Identification of the collaboration

Title of the collaboration	CP violation and strong interactions in hadronic decays of B and D mesons
Number of the collaboration	08-127
IN2P3 spokesperson	E. HONG-KOU
COPIN spokesperson	R. KAMINSKI
Scientific Domain	Hadronic and Particle Physics

#### Status of the collaboration

Status	The collaboration shall end on December 31st, 2022
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#### III. Status report for the period January 1st to December 31st, 2022

##### III.1 IN2P3 scientists in COPIN

Total time approved for 2022	0
Total time used for 2022	0
List of scientists	1. LOISEAU Benoit ( days) 2. MOUSSALLAM Bachir ( days)

##### III.2 COPIN scientists in France

Total time approved for 2022	0
Total time used for 2022	0
List of scientists	1. KAMINSKI Robert ( days) 2. LESNIAK Leonard ( days)

##### III.3 Scientific results of the above-mentioned collaboration

Description	
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Our Dalitz-plot analysis of the  $D^0 \rightarrow K_S^0 K^+ K^-$  BABAR Collaboration decay data has been published [1]. We are completing our analysis of the  $B^0 \rightarrow K_S^0 K^+ K^-$  decays. The meson final states are the same as in our study [1] but the phase space is much larger. This study should allow to constrain not only

the weak interaction observables but also the scalar kaon form factors, the transition matrix elements between one kaon and two kaons and to learn about the B0 transition to two kaons.

Within a quasi two-body QCD factorization framework the decay amplitude is derived in terms of unitary final-state meson-meson form factors. It will be the basis for the derivation of a parametrization that can be readily implemented in experimental analyses as an alternative to the sum of Breit-Wigner type amplitudes (isobar model). The dominant parts of this amplitude can reproduce, in a reasonable way, the available experimental total branching fraction together with the differential effective mass distributions. These have been extracted from the Belle and BABAR distributions [1, 2]. With 12 free parameters our model fits these data with a  $\chi^2$  per degree of freedom of about 1.5. Our model predicts that some CP asymmetry can be present in the Dalitz plot.

1] J.-P. Dedonder, R Kaminski, L. Lesniak and B. Loiseau, Phys. ReD **103**, 114028 (2021), Dalitz plot studies of  $D^0 \rightarrow K_S^0 K^+ K^-$  decays in a factorization approach; arXiv:2105.03355 [hep-ph].

[2] J.-P. Dedonder, R Kaminski, L.Lesniak, B. Loiseau, B. Moussallam, P. Zenczykowski, Amplitude analysis of the  $B^0 \rightarrow K_S^0 K^+ K^-$  process in a QCD factorization approach, work to be sent soon for publication.

[3] Y. Nakahama et al. (Belle Collaboration), Measurement of CP violating asymmetries in  $B^0 \rightarrow K_S^0 K^+ K^-$  decays with a time-dependent Dalitz approach, Phys. Rev. D **82**, 073011 (2010).

[4] J. P. Lees et al. (BABAR Collaboration), Study of CP violation in Dalitz-plot analyses of  $B^0 \rightarrow K^+ K^- K_S^0$ ,  $B^+ \rightarrow K^+ K^- K^+$  and  $B^+ \rightarrow K_S^0 K_S^0 K^+$  Phys. Rev. D **85**, 112010 (2012).

PS1 Jean-Pierre Dedonder, who retired in August 2017, has continued his collaboration. He did participate to our publication on Dalitz-plot analysis of the  $D^0 \rightarrow K_S^0 K^+ K^-$  BABAR Collaboration decay data. He is helping us in our amplitude analysis of  $B^0 \rightarrow K_S^0 K^+ K^-$  decay in a quasi-two-body QCD factorization approach.

PS2 B. Loiseau has a status of volunteer at Sorbonne Univert , Campus Pierre et Marie Curie up to August 31, 2023.

PS3 J.-P. Dedonder, R. Kaminski, L. Lesniak, B. Loiseau, and B. Moussallam thank the IN2P3-COPIN Committee for their financial support during these sixteen years of fruitfull collaboration.

Comment Validation	
Unity Director	Fadi IBRAHIM (IJCLab) - 2022-10-13 17:16:31