

粒子物理卓越创新中心优秀青年骨干

选拔报告

平荣刚

（高能物理研究所）

内容:

一. 2013--2014研究工作进展

1. 事例产生子工作进展
2. 物理分析工作进展

二. 服务工作

三. 承担/参加的基金项目和研究生培养

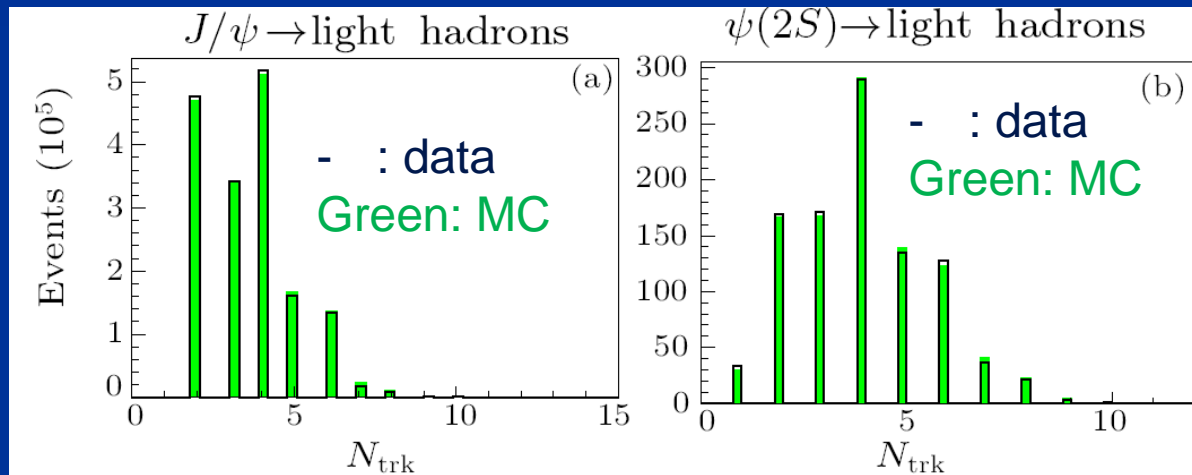
1. BESIII事例产生子的有关工作

作为BESIII事例产生子召集人，负责组织BESIII事例产生子软件的移植/软件的设计和版本升级维护。目前，这些产生子在BES物理实验中的亮度测量，物理分析中得到了广泛的使用，基本满足了BES物理分析的要求。

- 事例产生子代码的升级和维护：
BesEvtGen-00-02-57, Babayaga-00-00-26, KKMC-00-00-45 ...
- 为XYZ新粒子课题组的研究提供新的产生子模型 (ConExc)，包含了100个左右的衰变道，已经用于4GeV以上的能量点MC事例产生。
- J/ψ , ψ' 单举衰变产生子参数的优化
发展了一套新的方案，同时拟合数据的多个分布确定产生子参数的方法，克服了手动调节的很多弊端。这些参数已经在 J/ψ , ψ' 总数测量中应用。
- 跟踪用户的物理研究需求，随时创建和改造产生子模型，确保BES物理研究需要。

➤ 产生子研究的publication 和documentation

1. An exclusive event generator for e^+e^- scan experiments, Ping Ronggang, Chin. Phys. C38, 083001(2014).
2. Tuning and validation of Lundcharm model with J/ψ decays, Yang Ruiling, Ping Ronggang and Chen Hong, Chin. Phys. Lett. 31,061301 (2014).



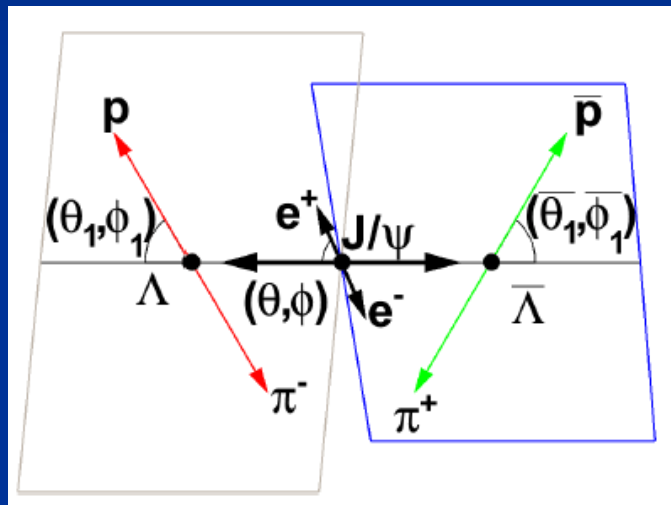
BESIII documentation: <http://docbes3.ihep.ac.cn/cgi-bin/DocDB/Search>

1. [Monte Carlo Generators for Tau-Charm-Physics](#), Ping Ronggang
2. [Manual of event generators for \$e^+e^-\$ scan experiments](#), Ping Ronggang
3. [Manual of generating continuum exclusive processes using KKMC](#), Ping RG

1. 物理分析工作进展

(1) Asymmetry parameter for the decay $\bar{\Lambda} \rightarrow \bar{p}\pi^+$

- Authors: Liu Jie, Ping Ronggang and Li Haibo
- Status : memo under collaboration review (BAM-00116)



$Y \rightarrow B\pi$ (Y : hyperon, B : baryon),

$$\frac{dN}{d\Omega} \propto 1 + \alpha_Y \vec{P}_Y \cdot \hat{p}_d$$

$$A = \frac{\alpha_\Lambda + \alpha_{\bar{\Lambda}}}{\alpha_\Lambda - \alpha_{\bar{\Lambda}}}$$

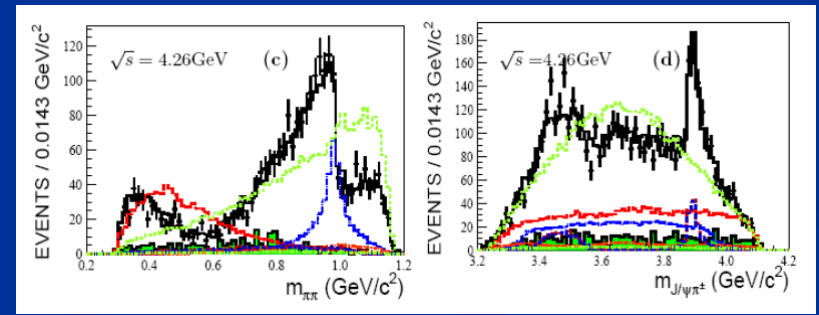
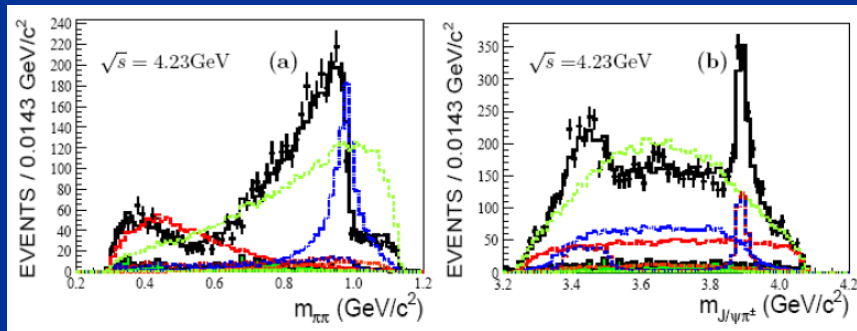
Study CP violation

- Precision is improved from 14% at BESII to 4%

BESIII	BESII
$\alpha = 0.496 \pm 0.017$	$\alpha = 0.70 \pm 0.06$
$\alpha_{\bar{\Lambda}} = -0.842 \pm 0.029$	$\alpha_{\bar{\Lambda}} = -0.755 \pm 0.083 \pm 0.063$
$A = -0.135 \pm 0.017$	$A = -0.081 \pm 0.055 \pm 0.059$

(2) Determination of $Z_c(3900)$ spin and parity J^P

- J^P are fundamental quantities for a state
- Authors: Ping Ronggang, Liu Zhiqing and Yuan Changzheng
- Status : memo under collaboration review (BAM-00127)

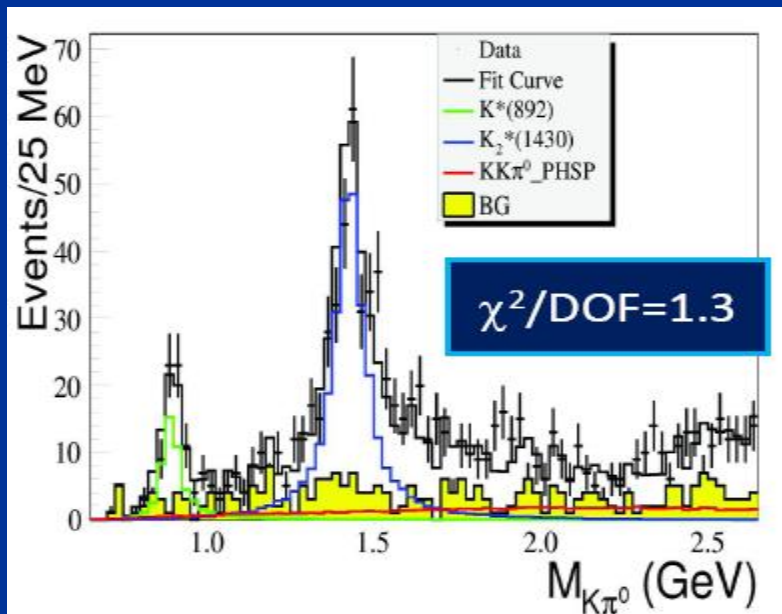


Born cross section at $\sqrt{s} = 4.23$ GeV:

$$\begin{aligned} \sigma^B(e^+e^- \rightarrow \sigma J/\psi \rightarrow \pi^+\pi^- J/\psi) &= 24.7_{-1.3}^{+1.4} \pm 9.9 \text{ pb}, \\ \sigma^B(e^+e^- \rightarrow f_0(980)J/\psi \rightarrow \pi^+\pi^- J/\psi) &= 23.5_{-1.1}^{+1.2} \pm 7.2 \text{ pb}, \\ \sigma^B(e^+e^- \rightarrow \sigma J/\psi \rightarrow f_0(1370)J/\psi) &= 71.8_{-1.2}^{+1.2} \pm 23.0 \text{ pb}, \\ \sigma^B(e^+e^- \rightarrow Z_c^+\pi^- + c.c. \rightarrow \pi^+\pi^- J/\psi) &= 15.2_{-0.5}^{+0.5} \pm 4.1 \text{ pb}, \end{aligned}$$

(3) Partial wave analysis on $\chi_{c2} \rightarrow \mathbf{K}^+\mathbf{K}^-\pi^0$

- Study helicity selection rule: $\chi_{c2} \rightarrow \mathbf{VP}, \mathbf{TP}$
- Authors: Xu Guofa, Ping Ronggang
- Status : memo under collaboration review (BAM-00112)

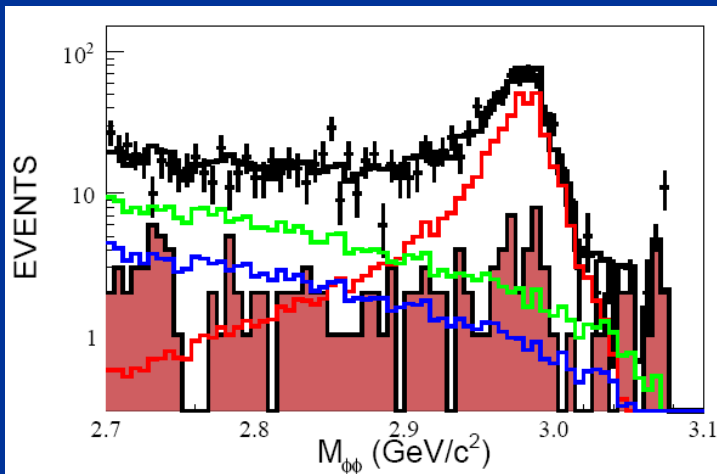


χ_{c2} ($\times 10^{-5}$)
$\text{Br}(\chi_{c2} \rightarrow \mathbf{K}^{*+}\mathbf{K}^- + \text{c.c.}) = 9.9 \pm 0.9 \pm 0.6$ 4.0~6.7 (Theo.)
$\text{Br}(\chi_{c2} \rightarrow \mathbf{K}^{*0}\mathbf{K}^0 + \text{c.c.}) = 9.4 \pm 1.0 \pm 0.7$ 4.0~6.7 (Theo.)
$\text{Br}(\chi_{c2} \rightarrow \mathbf{K}_2^{*+}\mathbf{K}^- + \text{c.c.}) = 130.1 \pm^{4.9}_{5.2} \pm 8.1$
$\text{Br}(\chi_{c2} \rightarrow \mathbf{K}_2^{*0}\mathbf{K}^0 + \text{c.c.}) = 131.0 \pm^{5.6}_{5.9} \pm 9.2$

First observation of $\chi_{c2} \rightarrow \mathbf{K}_2^* \mathbf{K}$

(4) $\eta_c \rightarrow \phi\phi, \omega\phi$ 分支比测量

- study helicity selection rule violation in η_c decays, and search for double-OZI decay
- authors: 廖广瑞, 平荣刚, 高原宁
- status: draft under BES internal review (BAM-000095)

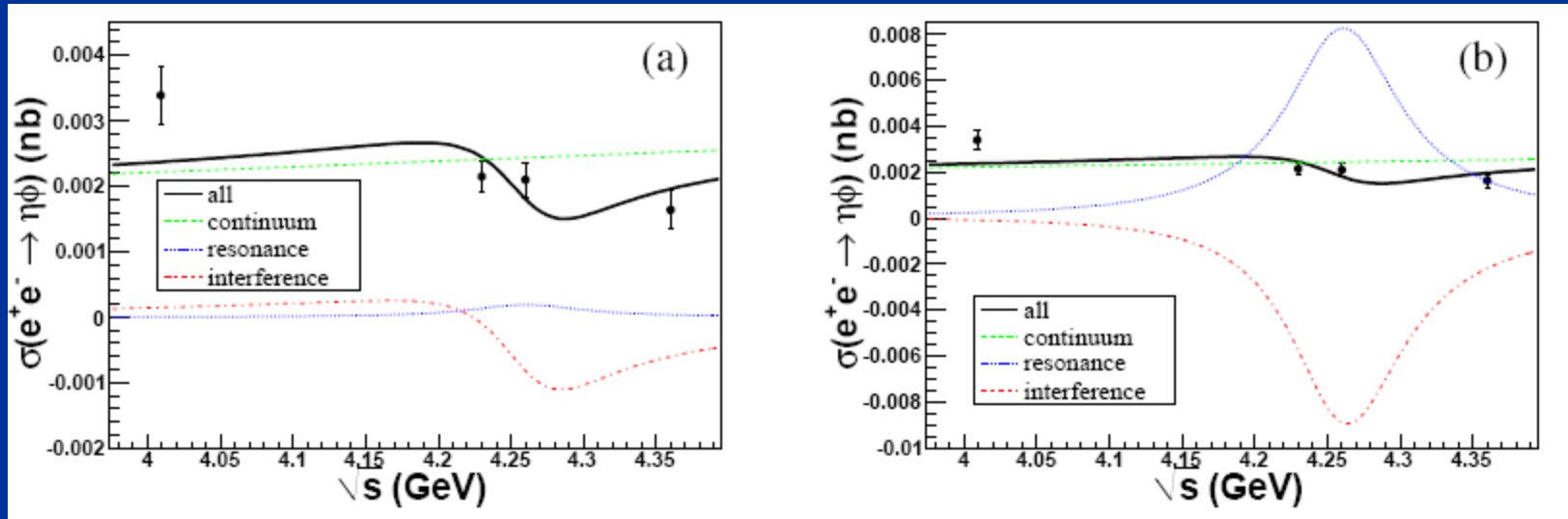


$$Br(\eta_c \rightarrow \omega\phi) < 3.26 \times 10^{-4},$$

$Br(J/\psi \rightarrow \gamma\eta_c, \eta_c \rightarrow \phi\phi) (10^{-5})$	$Br(\eta_c \rightarrow \phi\phi) (10^{-3})$	Comment
$3.55^{+0.16}_{-0.20} \pm 0.54$	$2.09^{+0.10}_{-0.12} \pm 0.58$	this measurement
$3.25 \pm 0.65 \pm 0.65$	$2.53 \pm 0.51 \pm 0.91$	BESII [3]
$3.3 \pm 0.6 \pm 0.6$	2.6 ± 0.9	BESII [2]
$3.9 \pm 0.9 \pm 0.7$	$3.1 \pm 0.7 \pm 1.0$	DM2 [1]

(5) 4.0 GeV以上 $\phi\eta$ 产生截面的测量

- Extract QCD sum rule of fundamental parameters, eg. Quark mass, α_s
- To get information of vacuum polarizations, and look for Y(4260) etc.
- **Authors:** 姜鲁文, 平荣刚
- **status** : To apply Collaboration review



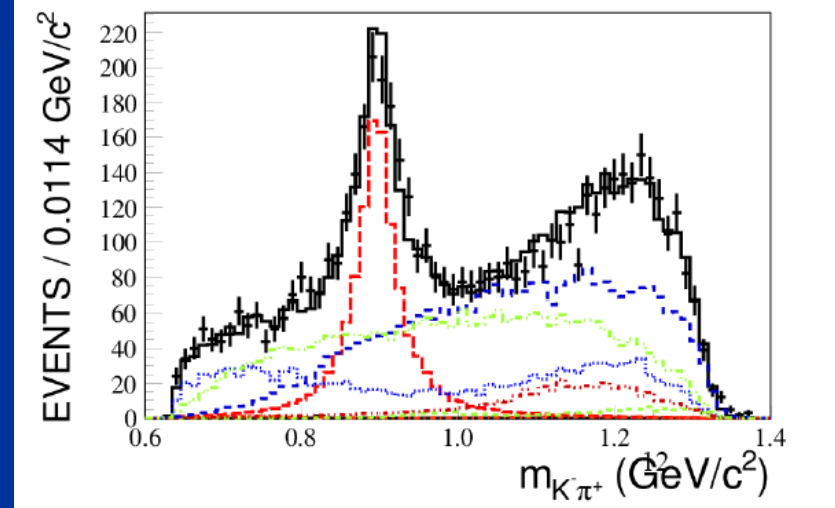
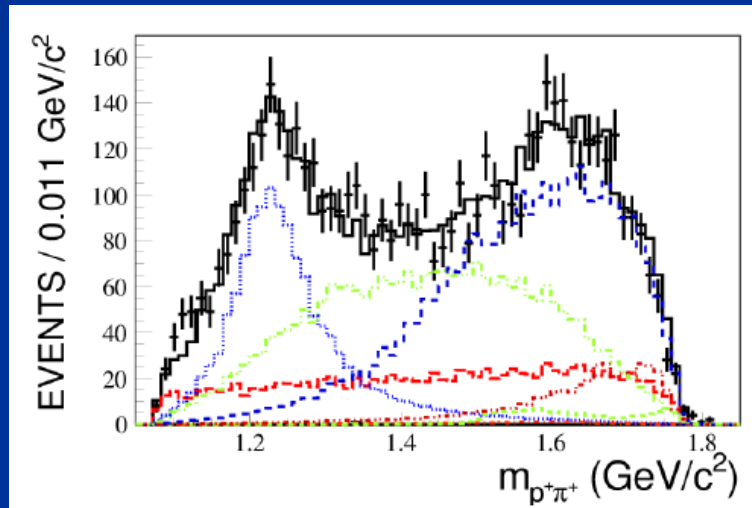
\sqrt{s} (GeV)	4.009	4.230	4.260	4.360
σ_{Born} (pb)	$3.39 \pm 0.40 \pm 0.17$	$2.15 \pm 0.21 \pm 0.10$	$2.10 \pm 0.24 \pm 0.10$	$1.64 \pm 0.26 \pm 0.13$
σ_{res1} (pb)	0.01	0.13	0.19	0.04
σ_{res2} (pb)	0.24	5.77	8.26	1.62

(6) Study of $\Lambda_c \rightarrow pK^+\pi^-$

- Large uncertainties for $\Lambda_c \rightarrow pK^+\pi^-$, $K^* p$, $\Delta(1232)K$, in PDG
- Recently, Bell: $\text{Br}[\Lambda_c \rightarrow pK^+\pi^-] = (6.84 \pm 0.24^{+0.21}_{-0.27})\%$ [PDG: $(5.0 \pm 1.3)\%$]

• **Authors:** 平菜刚

• **status** : Reported to the collaboration meeting, uncertainty study



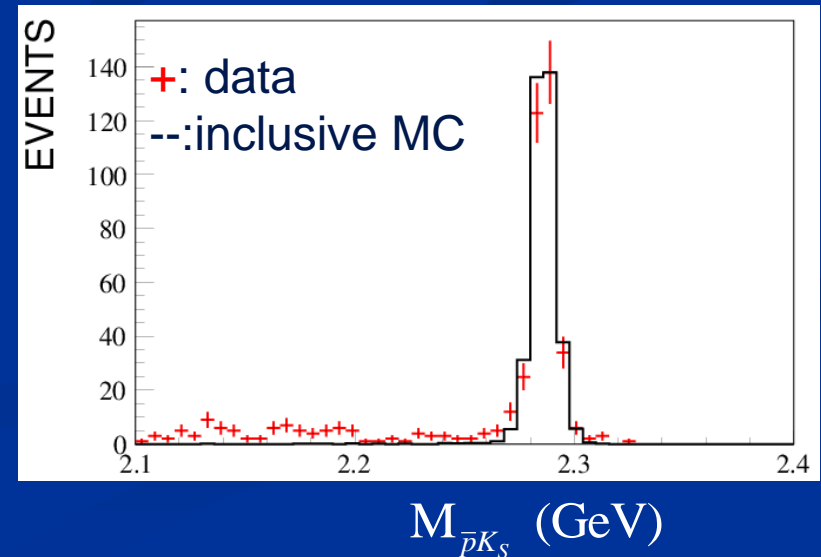
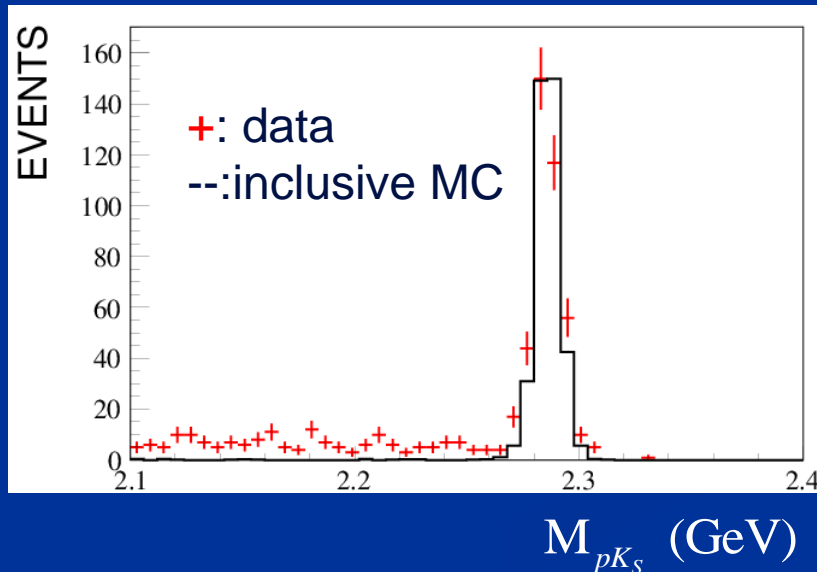
$$\text{Br}(\Lambda_c^+ \rightarrow pK^*(892)^0) = (1.50 \pm 0.06)\% , \text{ PDG: } (1.6 \pm 0.5)\%$$

$$\text{Br}(\Lambda_c^+ \rightarrow \Delta(1232)^{++} K^-) = (1.56 \pm 0.06)\% , \text{ PDG: } (8.6 \pm 3.0) \times 10^{-3}$$

$$\text{Br}(\Lambda_c^+ \rightarrow pK^-\pi^+) = (4.3 \pm 0.4)\%$$

(7) Determination of Λ_c spin

- Spin $J = \frac{1}{2}$ for Λ_c is quark model prediction
- Using sigle tag mode $e^+e^- \rightarrow pK_S^0\bar{\Lambda}_c^- + c.c.$
- Λ_c^+ spin is determined by fitting to data of jointed angular distribution
- This analysis have been reported to the BES collaboration meeting, and memo is under preparation.



(8) $\chi_{cJ} \rightarrow \phi\phi, \omega\omega$ 螺旋度振幅分析的实验方案

- violation of selection rule BESIII, PRL, 107, 092001

Mode	N_{net}	ϵ (%)	$\mathcal{B}(\times 10^{-4})$
$\chi_{c0} \rightarrow \phi\phi$	$8.0 \pm 0.3 \pm 0.8$
$\chi_{c1} \rightarrow \phi\phi$	$4.4 \pm 0.3 \pm 0.5$
$\chi_{c2} \rightarrow \phi\phi$	$10.7 \pm 0.3 \pm 1.2$
$\chi_{c0} \rightarrow \omega\omega$	991 ± 38	13.1	$9.5 \pm 0.3 \pm 1.1$
$\chi_{c1} \rightarrow \omega\omega$	597 ± 29	13.2	$6.0 \pm 0.3 \pm 0.7$
$\chi_{c2} \rightarrow \omega\omega$	762 ± 31	11.9	$8.9 \pm 0.3 \pm 1.1$

- To understand $\chi_{cJ} \rightarrow \phi\phi, \omega\omega$ decays, we proposed to perform helicity amplitude analysis and to measure ϕ/ω polarization (PRD88, 034025(2013))
- We start to measure the helicity amplitudes with 2009 and 2012 ψ' full data

二. 服务工作

-- 负责XYZ课题组的MC样本产生

- MC size: $\int L=1\text{fb}^{-1}$ [$\psi(4040)$], $\int L=500 \text{ pb}^{-1}$ [$\psi(4260)$], $\int L=800 \text{ pb}^{-1}$ [$\psi(4230)$], $\int L=500 \text{ pb}^{-1}$ [$\psi(4600)$]

- Processes: QED (Bhabha,dimu,ditau,digamm,qqbar)

$\psi(4040)$, $\psi(4260)$, $\psi(4600)$ \rightarrow open charm, hadronic decays, γ X/Y/Z

-- BES referee /chair

- J/psi \rightarrow K+K-pi0, by Igor Denysenko et al

J / $\psi \rightarrow \gamma\pi^0\pi^0$ (by Xu Guang Ming et al, draft stage)

- J / $\psi \rightarrow \gamma\eta\pi^0$ (By Wen Shuoping, et al, memo stage)

- search for $\chi_{c0,2} \rightarrow \pi^0 \eta_c$ (By Olga, et. al)

-- 发表文章

1. Polarization in $\chi_{cJ} \rightarrow \phi\phi, \omega\omega$, Chen Hong and Ronggang Ping, Phys. Rev. D 88 034025 (2013)
2. An exclusive event generator for e^+e^- scan experiments, Ping Ronggang, Chin. Phys. C38, 083001(2014).
3. Tuning and validation of Lundcharm model with J/ψ decays, Yang Ruiling, Ping Ronggang and Chen Hong, Chin. Phys. Lett. 31,061301 (2014).

三. 承担的基金项目 and 研究生培养

➤ 主持两项面上基金项目

1. 《 $\chi_{cJ} \rightarrow \phi\phi, \omega\omega, \omega\phi, \rho^0\rho^0$ 衰变机制的实验研究》

执行期间：2011年1月-2013年12月

2. 《 η_c 矢量介子衰变和 Λ_b 衰变参数的实验研究》

执行期间：2014年1月-2017年12月

➤ 参加：重点项目《新强子态和强子物理前沿研究》：

2014年-2017年

Publication list from 2005

1. Observation of Λ_c^+ decays into vector meson pairs. M. Ablikim, M.N. Achasov, L. An, et. al (BES Collaboration), Physical Review Letters, 107, 092001(2011). [其中平荣刚是主要撰稿人和通信作者]
2. Measurements of $\gamma(2S)$ Radiative decays, Physical Review Letters, M. Ablikim, J. Z. Bai, et al., (BES Collaboration)99,011802 (2007). [其中平荣刚是主要撰稿人和通信作者]
3. Experimental study of Λ_c^+ decays to ρ , M. Ablikim, M.N. Achasov, L. An, et. al (BES Collaboration), Physical Review D 86, 072011 (2012). [其中平荣刚是主要撰稿人和通信作者]
4. Precision measurements of branching fractions for Λ_c^+ , M. Ablikim, M.N. Achasov, L. An, et. al (BES Collaboration), Physical Review D 86, 092008 (2012). [其中平荣刚是主要撰稿人和通信作者]
5. Measurement of the asymmetry parameter for the decay, M. Ablikim, J. Z. Bai, Y. Ban, et. al. (BES Collaboration), **PHYSICAL REVIEW D 81, 012003 (2010)** [其中平荣刚是主要撰稿人和通信作者]
6. Measurement of Λ_c^+ decays to final states, M. Ablikim, J. Z. Bai, Y. Ban, et. al. (BES Collaboration), Physical Review D 73, 052006 (2006). [其中平荣刚是独立撰稿人和通信作者]
7. Polarization in Λ_c^+ , Hong Chen¹, and **Rong-Gang Ping**, Physical Review D 88, 034025 (2013)
8. Helicity amplitude analysis of hyperon nonleptonic decays in Λ_c^+ or Σ_c^+ decays, Hong chen, Rong-Gang Ping, Physical Review D 76, D76,036005 (2007).
9. Cross section of Λ_c^+ and Σ_c^+ , Zhu Kai, Yuan Changzheng, **Ping Ronggang**, Physical Review D 78, 036004 (2008).
10. Rescattering effects of baryon and antibaryon in heavy quarkonium decays, Hong Chen, **Rong-Gang Ping**, Phys. Lett. B 644, 54(2006).
11. Dynamically generated heavy mesons in a heavy chiral unitary approach, Feng-Kun Guo, Peng-Nian Shen, Huan-Ching Chiang, **Rong-Gang Ping** and Bing-Song Zou, Phys. Lett., B 641, 278(2006).
12. On the structure of the invariant mass spectra of the Λ_c^+ decays, Feng-Kun Guo, ..., **Rong Gang Ping**, Phys. Lett. B 658 (2007).
13. S wave scattering and effects of Λ_c^+ in Λ_c^+ , Guo Feng-Kun, **Ping Rong-Gang**, et.al., Nuclear Physics A 773, 78 (2006).
14. Study of X(1812) as a molecular state, Hong Chen, and **Rong-Gang Ping**, J. Phys. G: Nucl. Part. Phys. 34, 2679(2007).
15. Calculation of three body amplitude with high order Fierz transformation, Hong Chen, **RongGang Ping**, JOURNAL OF PHYSICS G: NUCLEAR AND PARTICLE PHYSICS, 35, 095001 (2008).
16. Production of X(1835) as baryonium with sizeable gluon content, Gui-Jun Ding, **Rong-Gang Ping** and Mu-Lin Yan, The European Physics J. A 28, 351 (2006).
17. Recent Results of Λ_c^+ decays from BESII, **Ping RongGang**, International Journal of Modern Physics A 21, 5639, (2006).
18. Physics at BES-III, D. M. Asner, et. al., International Journal of Modern Physics A 24, supplement 1, 1, (2009)。【平荣刚是部分章节的撰稿人】
19. Formalism of Helicity Coupling Amplitudes for Λ_c^+ , **Ping Rong-Gang**, Li Gang and Wang Zheng, Commun. in Theo. Phys. 47, 89 (2007).
20. Helicity Amplitude Analysis of Λ_c^+ Decays into Hyperon-Antihyperon Pairs, Pang Cai-Ying and **PING Rong-Gang**, Commun. Theor. Phys., 51, 1091 (2009).
21. Angular Distribution for Heavy Quarkonium Decays into Baryon-antibaryon Pairs, Pang Cai-Ying and **Ping Rong-Gang**, CHIN. PHYS. LETT., 24, 1441 (2007)
22. Helicity amplitude analysis of Λ_c^+ , Liao Guang-Rui, **Ping Rong-Gang** and Yang Yong-Xu, CHIN. PHYS. LETT. 26, 051101 (2009).
23. Baryon Resonance in Λ_c^+ , **Ping Rong-Gang**, Yuan Chang- Zheng, High Energy Physics and Nuclear Physics, 30, 731 (2006).
24. Tuning and validation of the Lundcharm model with Λ_c^+ decays, YANG Rui-Ling, **Ping Rong-Gang**, CHEN Hong, Chinese Physical Letters, 31, 061301 (2014).
25. Event Generators at BESIII, **Ping Rong-Gang**, Chinese Physics C, 32, 599 (2008).
26. Study of decay parameters in Λ_c^+ decay, Zhong Bin, **Ping Rong-Gang** and Xiao Zhengjun, Chinese Physics, C 32, 692 (2008).
27. Heavy Quarkonium transition and a possible state, Guo F.-K., Shen P.-N., Chiang H.-Q., **Ping Rong-Gang**, Nuclear. Physics. A 761:269-282, 2005.
28. 3P_0 quark-creation mechanism for Λ_c^+ decay to vector meson pairs, Zhou Hai-Qing, **Ping Rong-Gang**, and Zou Bing-Song, PHYSICAL REVIEW D 71, 114002 (2005).
29. Mechanisms for Λ_c^+ decays, Zhou Hai-Qing, **Ping Rong-Gang**, and Zou Bing-Song Physics Letters B 611, pp.123–128 (2005)
30. P-wave charmonium decays into baryon and antibaryon pairs in quark pair creation model, **Ping Rong-Gang**, Chaing Huai-Qing, European. Physical Journal. A 23, 129-133(2005)

4. 指导研究生的工作

刘杰（IHEP，副导师）：在读

联合培养：

杨蕊玲（西南大学）： 毕业

姜鲁文（武汉大学）： 在读

高永贵（广西师大）： 在读

指导学生完成的论文：

1. 杨蕊玲：硕士毕业论文，《 τ -粲能区事例产生子强子化模型的优化》

谢谢！