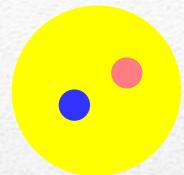
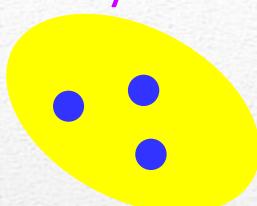


Hadron Spectroscopy

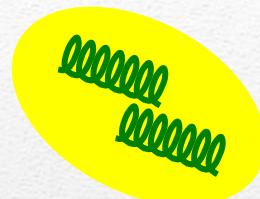
Meson



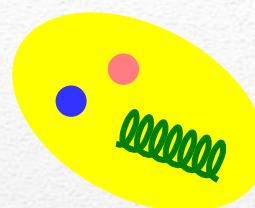
Baryon



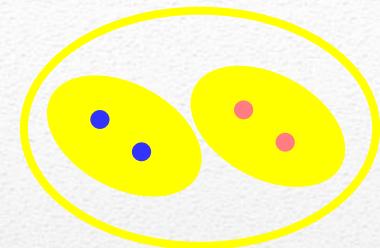
Glueball



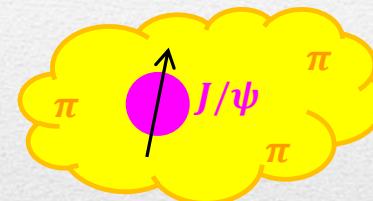
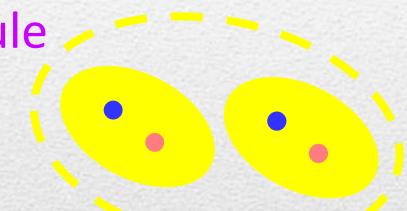
Hybrids



Tetraquark



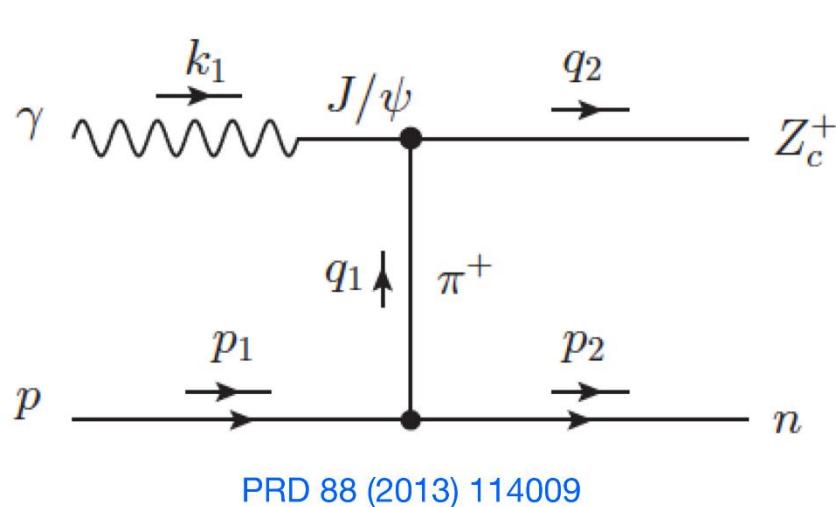
Molecule



Hadroquarkonium



XYZ states in photoproduction



$$\mathcal{L}_{V\gamma} = -\frac{eM_V^2}{f_V} V_\mu A^\mu$$

$$\mathcal{L}_{Z\psi\pi} = \frac{g_{Z\psi\pi}}{M_Z} (\partial^\mu \psi^\nu \partial_\mu \pi^\lambda Z_\nu - \partial^\mu \psi^\nu \partial_\nu \pi^\lambda Z_\mu)$$

$$\mathcal{L}_{\pi NN} = -\frac{g_{\pi NN}}{2m_N} \bar{N} \gamma_5 \gamma_\mu (\vec{\tau} \cdot \partial^\mu \vec{\pi}) N$$

- * Several proposals to study XYZ states in photoproduction
 - * $\gamma p \rightarrow Z_c^+(3900)n, Z_c^+ \rightarrow J/\psi \pi^+$ PRD 88 (2013) 114009
 - * $\gamma p \rightarrow Z_c^+(4430)n, Z_c^+ \rightarrow \psi' \pi^+$ PRD 77 (2008) 094005, PRC 83 (2011) 065203
 - * $\gamma p \rightarrow Z_c^+(4200)n, Z_c^+ \rightarrow J/\psi \pi^+$ arXiv:1503:02125 (incl. Regge trajectories in model)
 - * $\gamma p \rightarrow Y(3940)p, Y(3940) \rightarrow J/\psi \omega$ PRD 80 (2009) 114007
- * Use an Effective Lagrangian approach with Vector Meson Dominance

Comparison: EIC vs. others

Too late (?) for charm physics ✗



Flexibility in the production mechanism ✓

Flexibility in energy (no Λ_b) ✓

Less clean environment ✗



Same luminosity ✓

Lower cross sections ✗

Better efficiencies for neutrals (?) ✓



Polarized electron & ion beams ✓

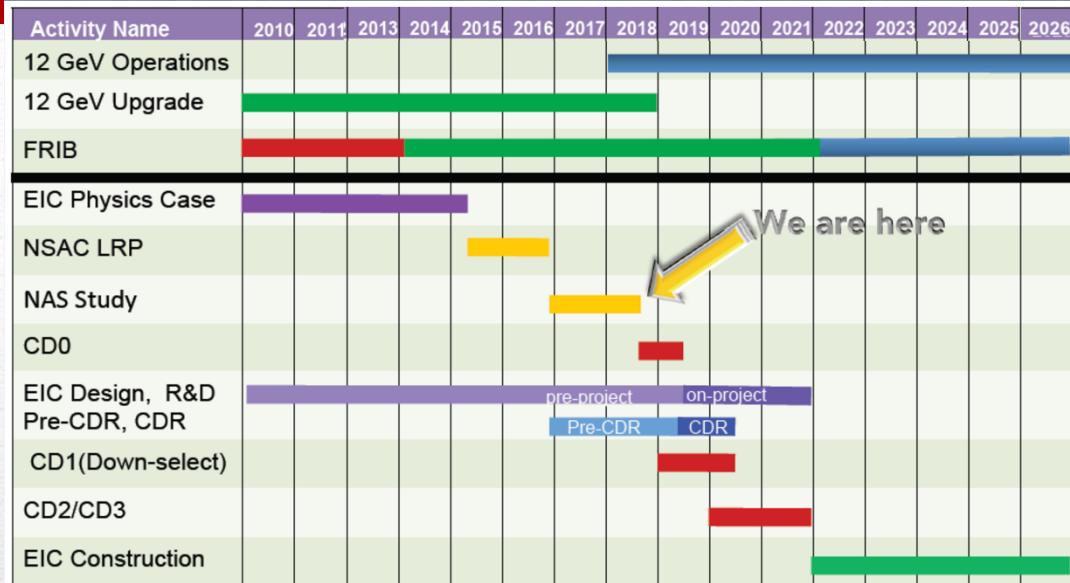
What for?

- High energy in the COM, possibility to study heavy flavors
 - Meson(-like) spectroscopy: $X_b, Z_b, (?)_b$
 - Baryon(-like) spectroscopy: $P_b, (?)_b$
 - Doubly heavy: $\Xi_{cc}, \Xi_{bc}; T_{bb}$
 - Gluon-rich (small-x): heavy hybrids production?
- Diffractive production (photon-pomeron fusion, Primakoff)
-

Need for cross section estimates
(NRQCD? Regge models?)

Timeline

- **July 2018:**
presentation of the project
at the EIC User group
- **December 2018:**
Workshop in Trento
- **Spring 2019:**
White book



CD0 = DOE "Mission Need" statement; CD1 = design choice and site selection (VA/NY)

CD2/CD3 = establish project baseline cost and schedule



EUROPEAN CENTRE FOR THEORETICAL STUDIES
IN NUCLEAR PHYSICS AND RELATED AREAS

ABOUT US WORKSHOPS TRAINING SEMINARS & COLLOQUIA PUBLICATIONS PEOPLE ASSOCIATES

[Home](#) » [Workshops](#) » This year workshops

[This year workshops](#)

[Next year workshops](#)

[Past workshops](#)

[Call for proposals](#)

[Guidelines for workshop
organizers](#)

[Instructions for participants](#)

[Transnational Access](#)

2018 Workshops and collaboration meetings

[The spectroscopy program at EIC and future accelerators](#)

19 Dec 2018 to 21 Dec 2018

Organizers

Marco Battaglieri (INFN Genova) battaglieri@ge.infn.it

Adam Szczepaniak (Indiana University & Jefferson Lab) aszczepa@indiana.edu

Alessandro Pilloni (Jefferson Lab) pillaus@jlab.org

Working group

- **Theorists:**
F.K. Guo (CAS), T. Mehen (Duke), A. Pilloni (JLab), A. Szcepaniak (IU/JLab)
- **Experimentalists:**
M. Battaglieri (INFN-GE), Y. Furletova (JLab), J. Stevens (W&M)