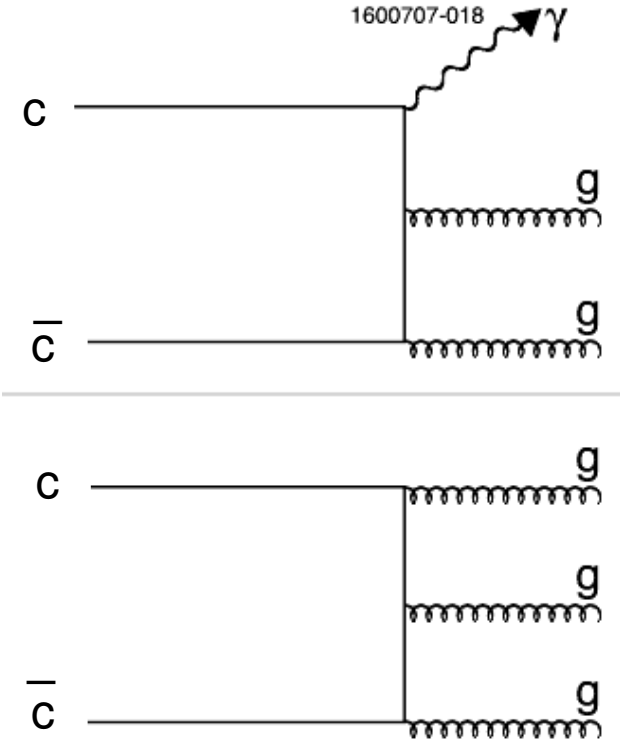
The Radiative Decay $J/\psi \rightarrow \gamma\pi\pi\pi\pi$

Why?

It is hard to study gluons, the carriers of the strong force

J/ψ are produced easily at CESR

When the quarks inside J/ψ annihilate, they make high energy gluons



Gluons can't be produced singly

Conservation of angular momentum and charge conjugation force gluons to be produced in threes in J/ψ decay

By demanding a photon, we can conserve quantum numbers, let the photon escape, and are left with only two gluons, which we can then study.

How?

$e^+e^- \rightarrow \psi(2S)$

$\hookrightarrow \pi^+\pi^- J/\psi$

$\hookrightarrow \gamma \pi^+\pi^-\pi^+\pi^-$

Why not done before?

Need good photon detection combined with good charged particle tracking

CLEO is the first detector in the charm region with both state-of-the-art

Technique

CLEO delivers a list of tracks and photons in an event

Bethany puts them together to see if they

1) Account for everything in the event (energy, momentum conservation)

2) Are consistent with the desired decay pattern

Carefully count occurrences to calculate decay rates