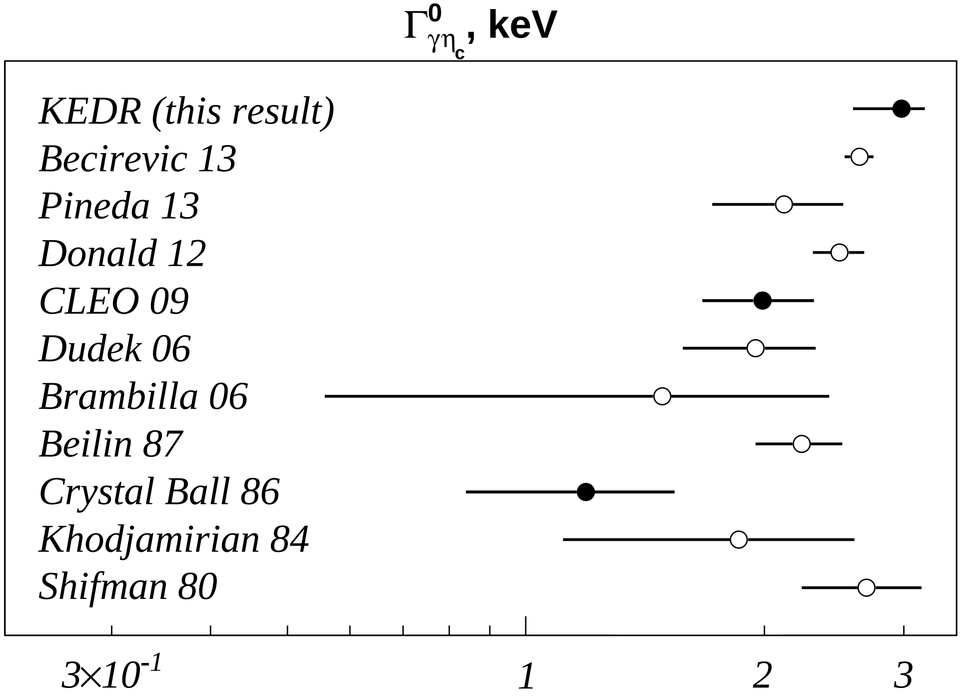
$J/\psi \to \gamma\, \eta_c$

Antonio Vairo

Technische Universität München

The $J/\psi \to \gamma\,\eta_c$ width



- KEDR coll. PLB 738 (2014) 391

Experiment

Data are used to fix the paramters of a theoretical signal given by

$$E_\gamma^3 \times \mathrm{BW}^{\mathrm{rel}}(E_\gamma) \times \mathrm{damping}(E_\gamma)$$

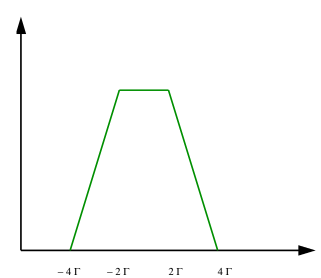
which integrated over the photon energy E_γ gives the width.

– $\mathrm{BW}^{\mathrm{rel}}(E_\gamma)$ is the relativistic Breit–Wigner:

$$\mathrm{BW}^{\mathrm{rel}}(E_\gamma) = \frac{1}{(M_{J/\psi}^2 - 2M_{J/\psi}E_\gamma - M_{\eta_c}^2)^2 + (M_{J/\psi}^2 - 2M_{J/\psi}E_\gamma)^2\Gamma_{\eta_c}}$$

– $\mathrm{damping}(E_\gamma)$ is a damping function:

- $\mathrm{damping}(E_\gamma)_{\mathrm{CLEO}} = \exp[-E_\gamma^2/(8 \times (65.0 \pm 2.5\,\text{MeV})^2)]$
- $\mathrm{damping}(E_\gamma)_{\mathrm{KEDR}} =$



Theory

- More consistent with the $\propto E_\gamma^3$ parameterization is a non-relativistic Breit–Wigner distribution:

$$\mathrm{BW}^{\mathrm{nonrel}}(E_\gamma) = \frac{E_\gamma^2}{(M_{J/\psi} - M_{\eta_c} - E_\gamma)^2 + \Gamma_{\eta_c}^2/4}$$

- Damping functions do not seem to have a theoretical justification.

- Theory and experiment do not compute exactly the same quantity.

  Theoretical approaches calculate

$$\langle \eta_c | J_\mu^{\mathrm{em}} | J/\psi \rangle$$

  which is as to assume the η_c to be stable.