goal............understand the QCD basis of diffraction & discover new physics

TEV2LHC...confirm, extend, discover...

Tools........lager √s → larger σ, Δη & E_T

TODO:

- Elastic, diffractive, and total cross sections
  - Important to study partial cross section components
    - need topology (multiplicity, E_T, ...)

- Hard diffraction
  - diffractive structure function → dijets vs. W
  - Multigap configurations
  - Jet-gap-jet → dσ/dΔη vs. E_Tjet → BFKL, Mueller-Navelet
**p-p Interactions**

### Non-diffractive:
**Color-exchange**
- Incident hadrons acquire color and break apart
- **CONFINEMENT**

### Diffractive:
**Colorless exchange with vacuum quantum numbers**
- Incident hadrons retain their quantum numbers remaining colorless
- **DECONFINEMENT**

**Goal:** understand the QCD nature of the diffractive exchange
Rapidity Gaps in Fireworks
Dark Energy

Non-diffractive interactions

Rapidity gaps are formed by multiplicity fluctuations:

\[ P(\Delta y) = e^{-\rho \Delta y}, \quad \rho = \frac{dN_{\text{particles}}}{dy} \]

\( P(\Delta y) \) is exponentially suppressed

Diffractive interactions

Rapidity gaps at \( t=0 \) grow with \( \Delta y \):

\[ \Delta y \approx -\ln \xi = \ln s - \ln M^2 \]

\[ P(\Delta y)\bigg|_{t=0} \sim e^{2\varepsilon \Delta y} \]

2\( \varepsilon \): negative particle density!

Gravitational repulsion?