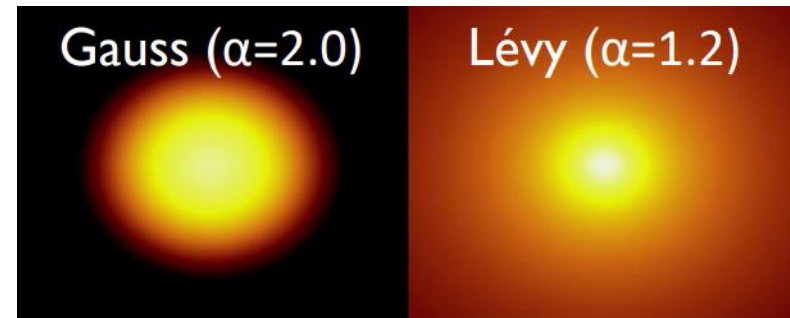
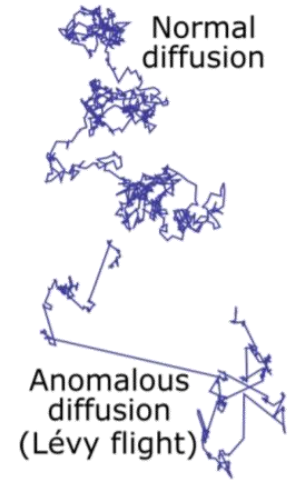
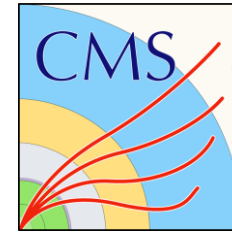


# Lévy HBT

- Momentum correlation  $\leftrightarrow$  source function :  $C(q) \approx 1 + |\tilde{S}(q)|^2$
- Lévy distribution:  $L(\mathbf{r}; \alpha, R) = (2\pi)^{-3} \int d^3\mathbf{q} e^{i\mathbf{q}\mathbf{r}} e^{-\frac{1}{2}|\mathbf{q}R|^\alpha}$
- Many possible reasons<sup>1,2,3</sup> i.e. anomalous diffusion, critical phenomena ...
- Lévy-type source + core-halo model:  $C(q) = 1 + \lambda e^{-|qR|^\alpha}$
- Detailed centrality-dependent **Lévy shape analysis**
  - Measurement of:
    - Lévy stability index  $\alpha \rightarrow$  shape
    - Lévy scale parameter  $R \rightarrow$  spatial scale
    - Correlation strength  $\lambda \rightarrow$  core-halo, partial coherence
  - Study the centrality and  $m_T$  dependence

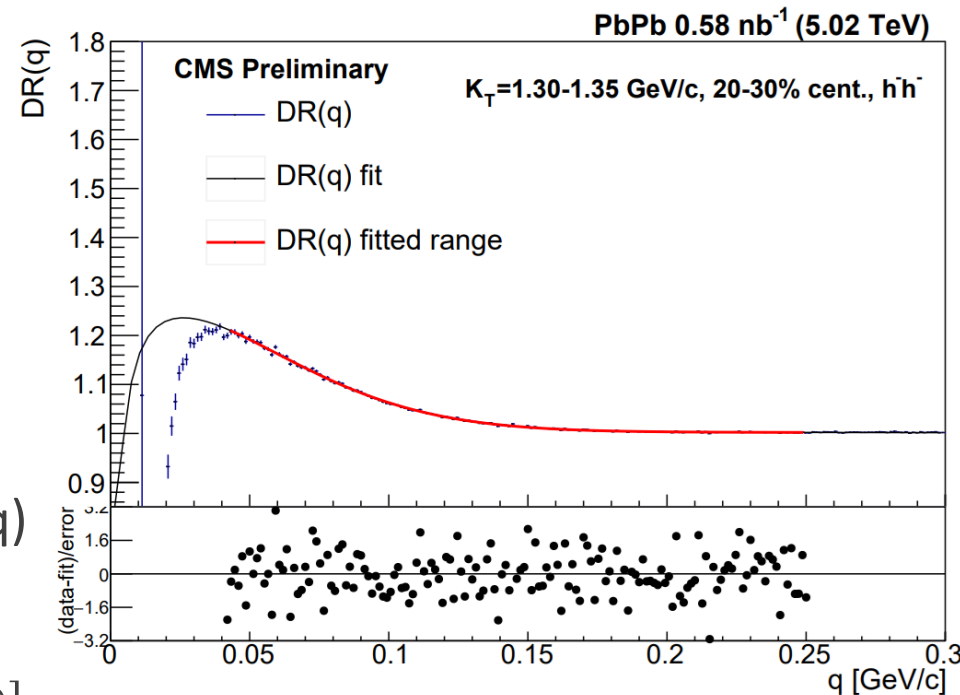


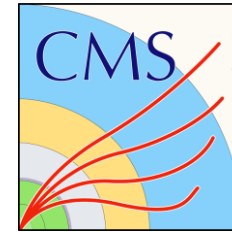


# Analysis details

- 5.02 TeV PbPb data from CMS
- Calculate the correlation function:
 
$$C(q) = \frac{A(q)}{B(q)} \cdot \frac{\int B}{\int A}$$
  - A(q) actual (same event) pair distribution
  - B(q) background (mixed event) pair distribution
- Remove long-range background → DR(q)
- Obtain the parameters via fitting<sup>1,2</sup>:

$$DR(q) = N(1 + \varepsilon q) [1 - \lambda + \lambda(1 + e^{-|qR|^\alpha}) K_C(q; \alpha, R)]$$





# Main results

- Lévy source shape
- $\alpha$  between 1.6 and 2.0
  - Centrality-dependent
  - Constant in  $m_T$
- Hydro-like linear scaling:  $1/R^2 \sim m_T$
- $R$  linear scaling in  $\langle N_{\text{part}}^{1/3} \rangle \rightarrow$  spatial scale
- Decreasing  $\lambda$  vs.  $m_T$ 
  - Caused by the lack of particle id.
- For details see the upcoming poster or [CMS-PAS-HIN-21-011](https://cds.cern.ch/record/2781143/files/CMS-PAS-HIN-21-011.pdf)

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