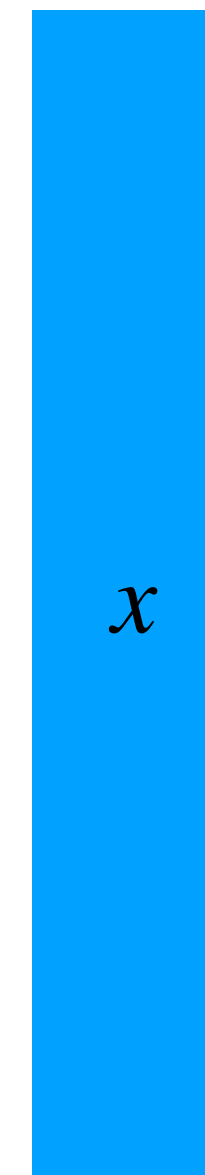


Fast and Space Optimal Streaming Algorithms

with Mikkel Thorup, Rasmus Pagh and David Woodruff [FOCS '23]

Turnstile Streaming

- Initialize $x \leftarrow 0 \in \mathbb{R}^n$
- On update (i, Δ) :
 - Set $x[i] \leftarrow x[i] + \Delta$
- Answer queries about x using **small space**
 - $\max_i |x[i]|$
 - $\sum_i |x[i]|^p$ (F_p moments)



Updates: $(i_1, \Delta_1) (i_2, \Delta_2) \dots (i_m, \Delta_m)$