



**LinearMeasurementsMatrix-VectorProducts**

- If  $A$  is  $n \times n$ , matrix-vector products can be simulated with  $n$  linear measurements

- $n$  linear measurements are at least as powerful as one matrix-vector product

Tracked and computed exactly with one linear measurement

- Requires  $\Omega(n)$  matrix-vector products for exact trace

• Sun, Wodruff, Yang, Zhang '21 (Triangle detection)

- Requires  $\Omega(1/\varepsilon^2)$  for approximating up to  $1 \pm \varepsilon$



• Wimmer, Wu, Zhang '14

# Linear Measurements vs Matrix-Vector Products

- If  $A$  is  $n \times n$ , matrix-vector products can be simulated with  $n$  linear measurements
- $n$  linear measurements are **at least** as powerful as one matrix-vector product
- Trace can be computed exactly with **one** linear measurement
  - Requires  $\Omega(n)$  matrix-vector products for exact trace
    - Sun, Woodruff, Yang, Zhang '21 (Triangle detection)
  - Requires  $\Omega(1/\varepsilon^2)$  for approximating up to  $1 \pm \varepsilon$ 
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# Upper Bounds