# 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 unto $1 \pm \varepsilon$
    - Wimmer, Wu, Zhang ‘14

# Upper Bounds

- With $n^2$ linear measurements, can read entire matrix
  - 1 round and $n^2$ linear measurements suffice
- For constant $r$, $O(\log n)$ iterations of power method suffice
  - $O(\log n)$ rounds and $O(n)$ linear measurements per round suffice
- What is the measurements-vs-rounds tradeoff?