1138-68-300 **Rafael Oliveira*** (rafael@cs.toronto.edu), rafael@cs.toronto.edu, and **Klim Efremenko**, **Ankit Garg** and **Avi Wigderson**. *Barriers for Rank Methods in Arithmetic Complexity.*

Arithmetic complexity is simpler than Boolean complexity. And we seem to have more lower bound techniques and results in arithmetic complexity than in Boolean complexity. Despite rapid progress, foundational challenges, like proving super-polynomial lower bounds on circuit size for explicit polynomials, or super-linear lower bounds on explicit 3-dimensional tensors, remain elusive. At the same time, barrier results explain why we failed to prove basic lower bounds in Boolean complexity. Despite previous attempts we have no such barriers in arithmetic complexity. In this talk we give the first unconditional barriers for rank methods, which were long recognized as encompassing almost all known arithmetic lower bounds to-date. We show that rank methods cannot prove lower bounds better than:

- $\Omega_d(n^{\{\lfloor d/2 \rfloor\}})$ on the tensor rank of any d-dimensional tensor of side n. (In particular, they cannot even prove a $> 6n$ lower bound for any 3-dimensional tensors.)
- $\Omega_d(n^{\{\lfloor d/2 \rfloor\}})$ on the Waring rank of any n-variate polynomial of degree d.

These bounds nearly match the best explicit bounds we know for these models, and hence explain why rank methods got stuck there. (Received February 13, 2018)