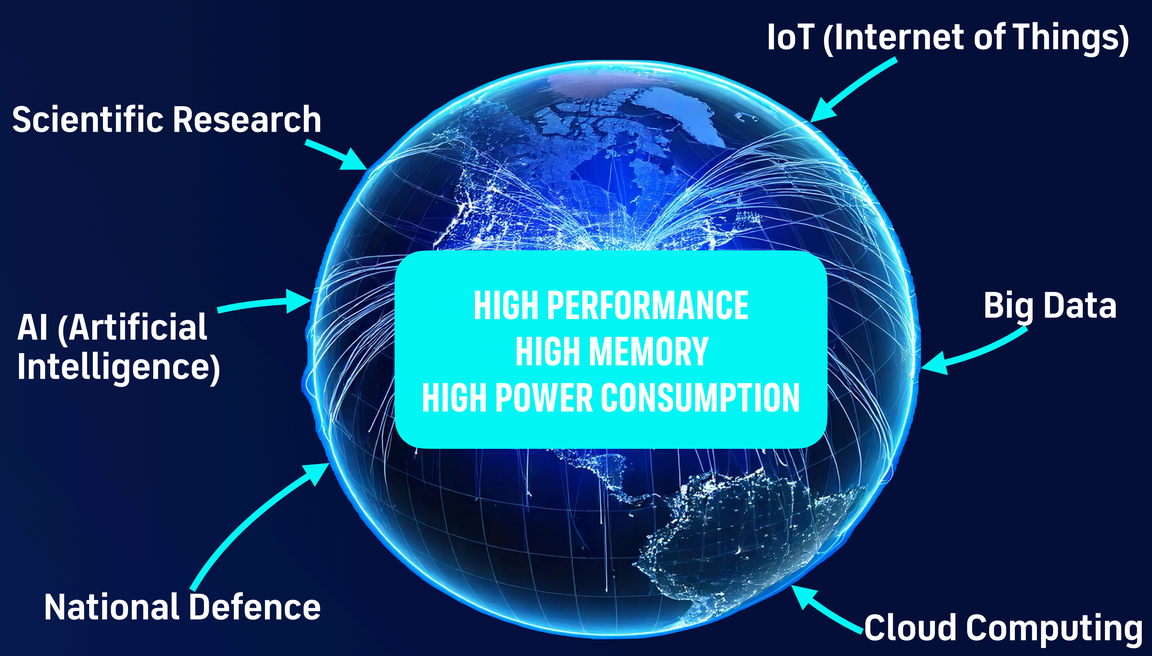
MAGNETIC RAM: THE UNIVERSAL MEMORY OF THE FUTURE?

Modern RAM places a burden on power systems. We need a new solution that supports our rate of technological growth.

1. THE PROBLEM

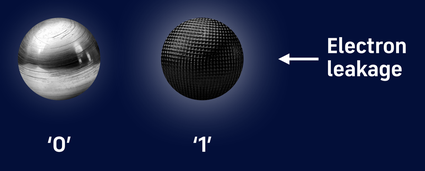
Evolving technological trends necessitate larger and more powerful computing systems, which consume a large amount of electrical power.



Computer RAM accounts for 30 to 50% of energy consumption of these systems. Modern RAM is inefficient, which is a fundamental limitation of the technology; This is innevitable.

2. HOW MODERN RAM WORKS

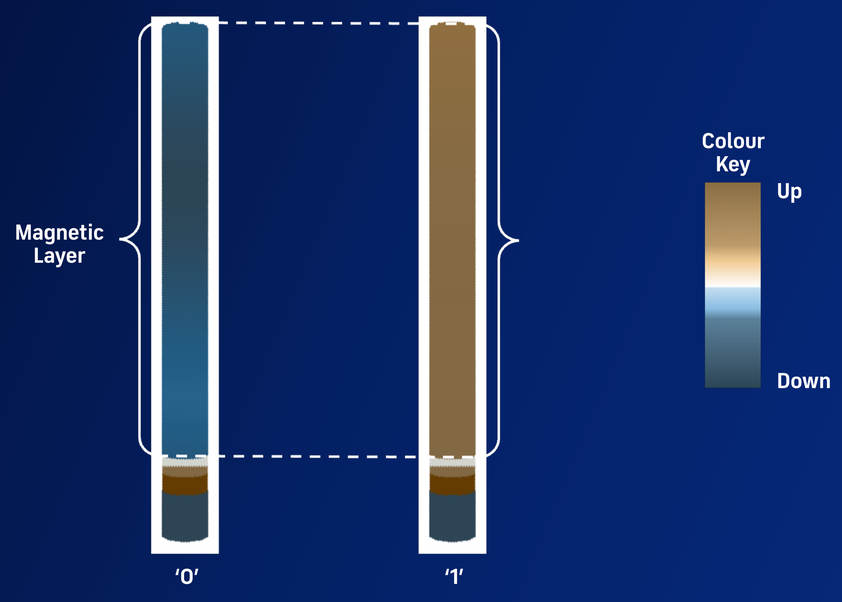
Modern RAM consists of a capacitor that can either be full '1', or empty '0'.



And a full capacitor also suffers from 'leakage' of electrons, so must be constantly refreshed, drawing continuous power *(volatile)*. ***This is a limit of the tech. We need a solution.***

3. HOW MAGNETIC RAM WORKS

In contrast to modern RAM, **Magnetic RAM is non-volatile**, meaning that once a magnetic state is saved, it draws no further power, thus it consumes less power.

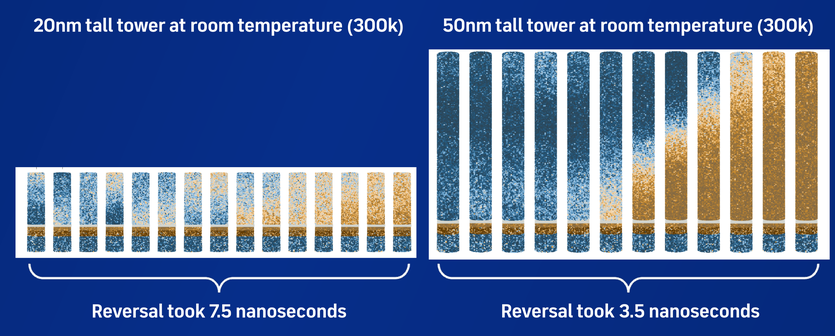


Magnetic RAM consists of a magnetic layer, which can align up '1', or down '0'. It is reversed via a '**reversal current**'. Once a magnetic state is saved, it draws no further power **(non-volatile).**

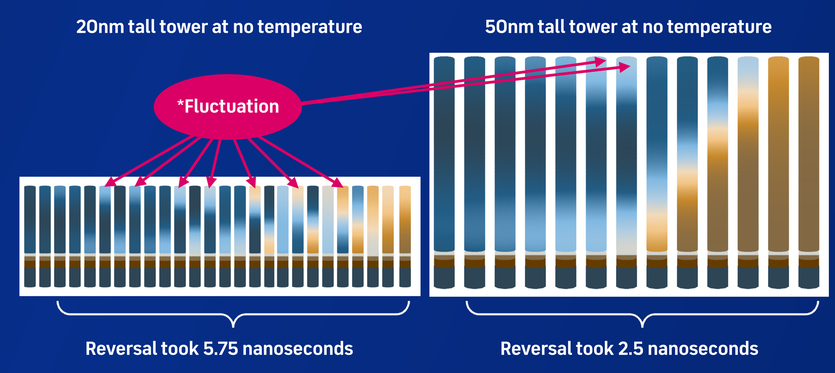
This work aims to understand its behaviours, limitations and viability via an atomistic model, VAMPIRE[1]; With this model we were able to simulate the towers at varying heights and temperatures to determine the viability of this new technology[2].

4. MAIN FINDINGS (IN BRIEF)

At room temperature, both 20nm and 50nm tall tower displayed significant fluctuation* and slower reversal. However, we do see better performance from a taller tower.

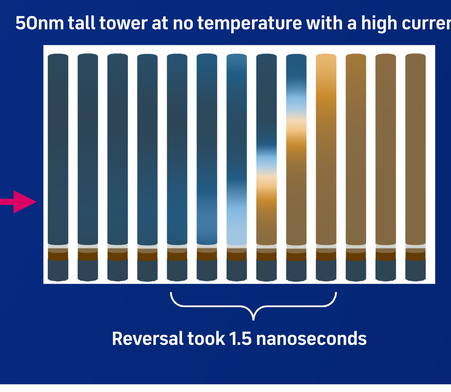


At no temperature, results are **unexpectedly faster** and we observe fewer fluctuations. Taller towers continue to perform better.



When we introduce a much larger reversal current we observe no fluctuations and much faster reversal.

Under these conditions Magnetic RAM is viable and could replace modern RAM.



5. CONCLUDING REMARKS

Magnetic RAM is a strong candidate for a universal memory in the future. The reversal mechanism from a '0' to a '1' is complicated, and heavily depends on the current, temperature and size of the magnetic RAM tower, but it could optimise global technological infostructures. **Thereby, enabling our continued technological advancement.**

[1]Evans R F L 2020 available at: git://github.com/richard-evans/vampire.git

[2]W. Lack et. al. - "Thermodynamic properties and switching dynamics of perpendicular shape anisotropy MRAM" (2024)