Understanding our Universe with AI : aims and challenges

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LUTH Students Day

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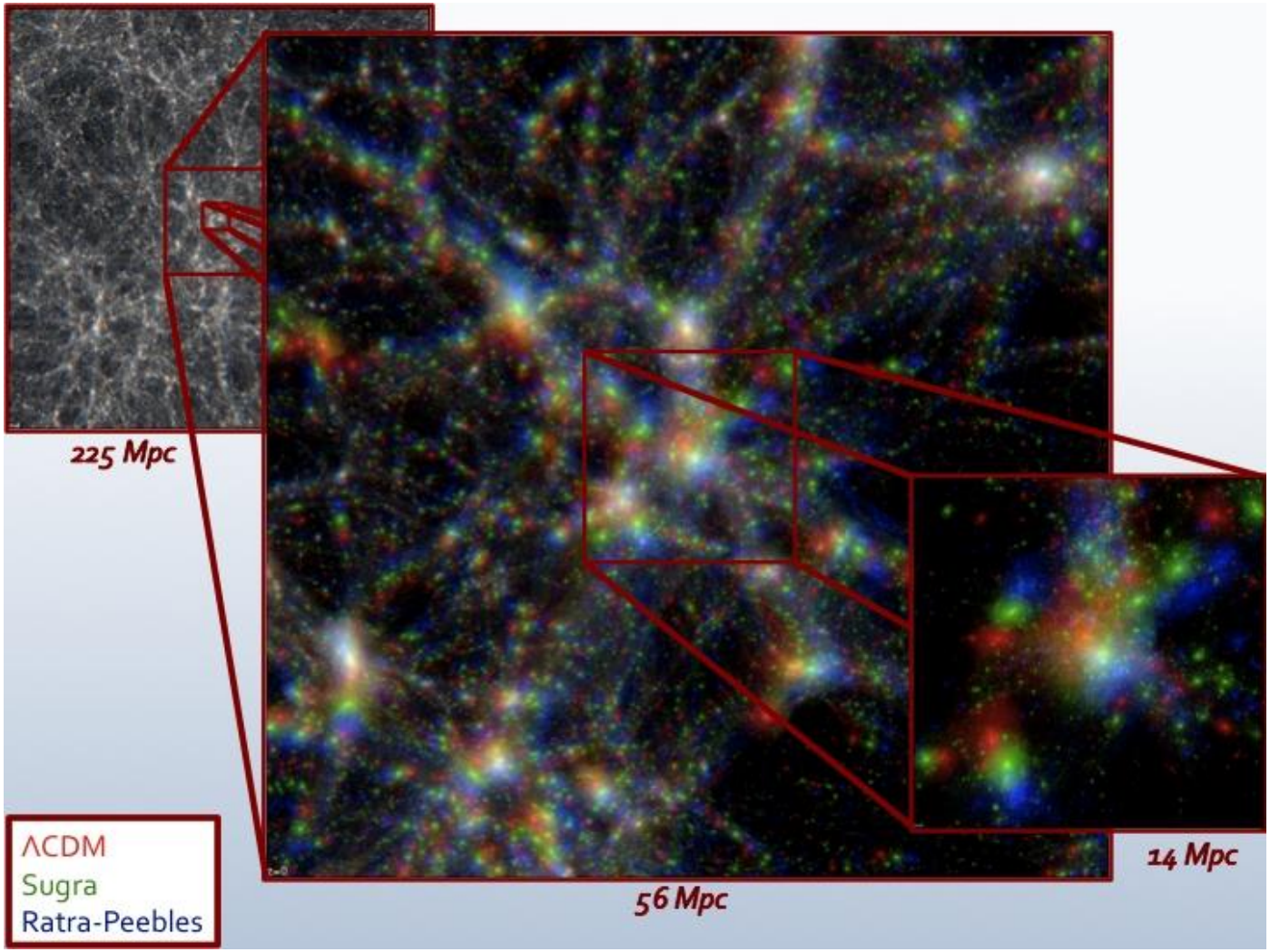
- Those are REALISTIC models $\Rightarrow$ the final Universes are very close one to each other [Alimi&al 2010]

Making the difference ...



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- Can we predict/discriminate the cosmology by analyzing the halos ?
- If so, what are the discriminatory halo properties ?

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  4. We try to determine which properties are important to achieve the recognition - those are the "cosmologically impregnated" attributes. this is a physical output

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"The 'Clever Hans' effect occurs when the learned model produces correct predictions based on the 'wrong' features. This effect [...] goes undetected by standard validation techniques has been frequently observed [...] where the training algorithm leverages spurious correlations in the data." [Kauffman & al 2020]

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Conclusion and perspectives

- Our objective is to detect and localize cosmological imprints in halos properties.
- Signals are weak, AI could be a solution.
- But we do not only want an AI that works on the simulation, we want an AI that would work on real/physical examples.
- This is why one should understand how the AI works and track any Clever Hans.
- This means that, crucially, one has to pave the way with much physical knowledge.

Perspectives :

- Extension to projected halos
- Application to observed clusters (weak lensing ...)
- Extension of cosmological detection to gravity-theory detection

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