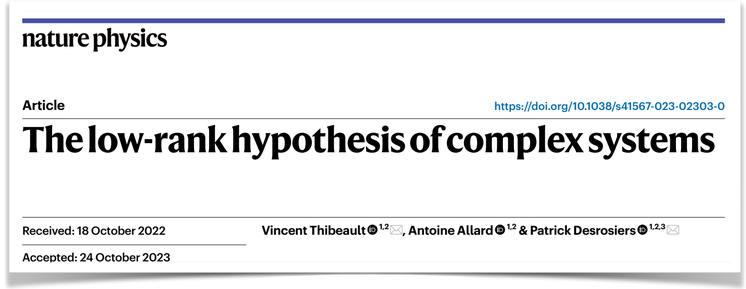
Main takeaways

- The rapid decrease of the singular values of adjacency matrices (i.e. low effective rank) offers a *justification* for low-dimensional mathematical models beyond mathematical and/or conceptual convenience.
- A large proportion of real networks can be considered as having a low effective rank.
- The higher-order interactions observed in some systems could be a byproduct of a low-dimensional representation used to analyze them.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The low-rank hypothesis of complex systems

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Vincent Thibeault[1,2], Antoine Allard[1,2] & Patrick Desrosiers[1,2,3]

Challenges and open questions

- Could we measure the effective dimension independently?
- Could we design a random graph model based on observed singular values (singular vectors)?
- Are some of the higher-order interactions inferred from time series artifacts of coarse-grained observations?
- Could we designed more interpretable observables, perhaps nonlinear ones?

Vincent Thibeault
Université Laval

Patrick Desrosiers
Université Laval
CERVO Brain research center

Outline

1. Are simple models enough to study complex systems/networks?

2. **“Simple” ways to encode structural complexity**

   (a) latent metric space

   (b) stub types