

Quantum Entanglement and the Flow of Time Animations

Entropy

By Mark Egdall 6/15/ 09
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Based on Brian Greene's *The Fabric of the Cosmos*

3. Animation on Entropy:

- The motion of a *small* number of things tend to look about the same forward *or* backward in time.
- But a *large* number of things tend to show a difference in the forward and backward time directions.

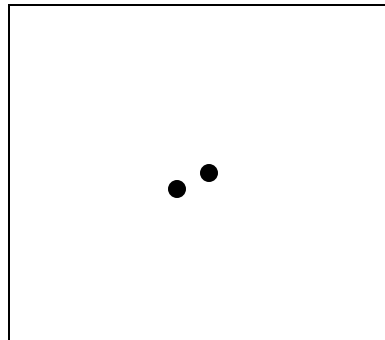
→ Higher entropy (disorder) over time.

NOTE: Animation is not a rigorous simulation. It is meant only to convey the concept of entropy.

Based on Brian Greene's *The Fabric of the Cosmos*

Small Number of Constituents *

- A couple of CO₂ molecules placed together in small box
 - Hard pressed to say whether film running forward or in reverse

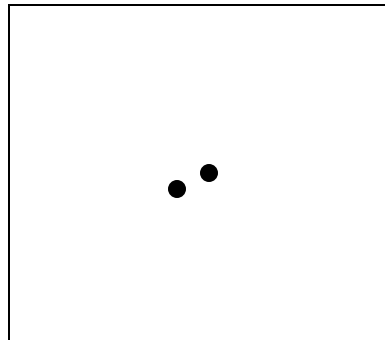


Time 0

* p. 157, *Fabric of the Cosmos*, B. Greene

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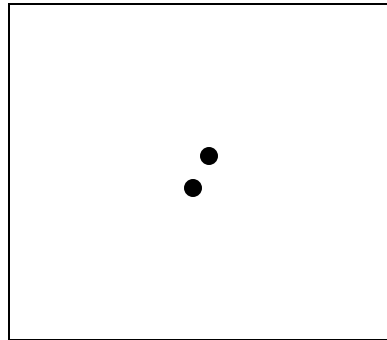


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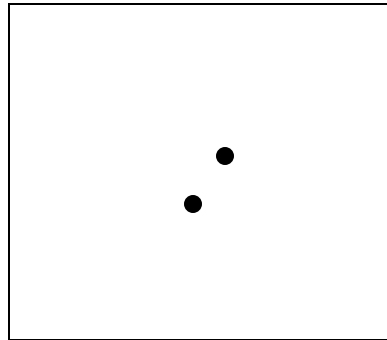
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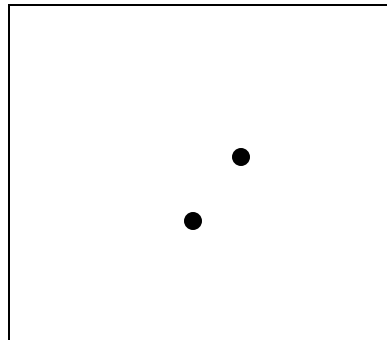
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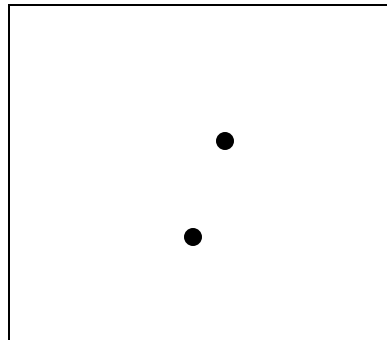
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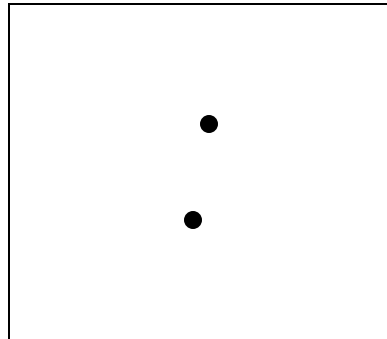
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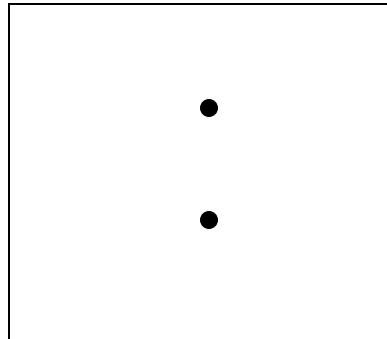
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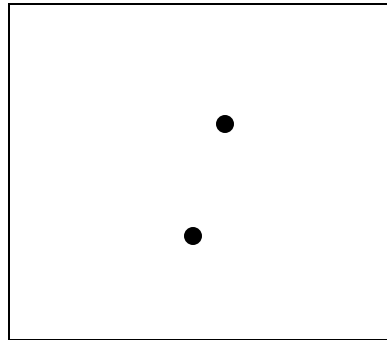
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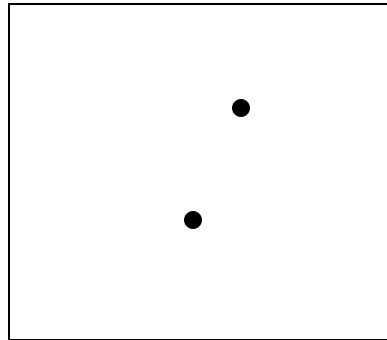
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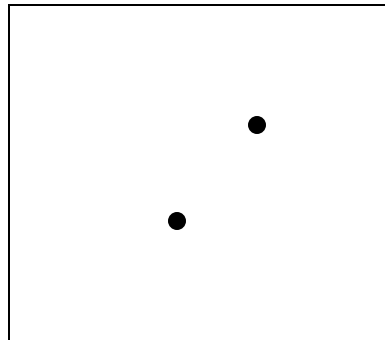
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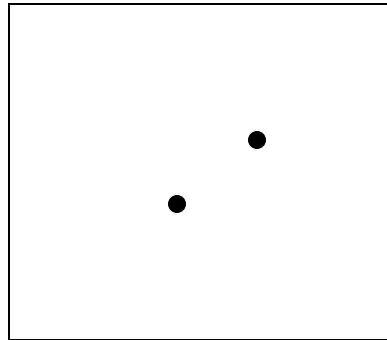
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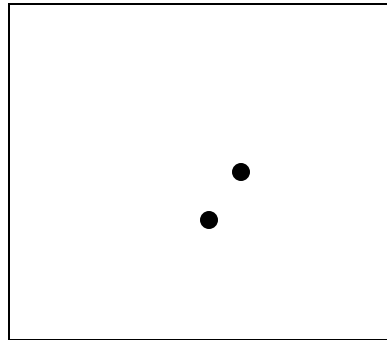
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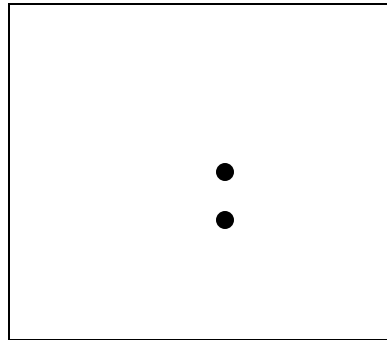
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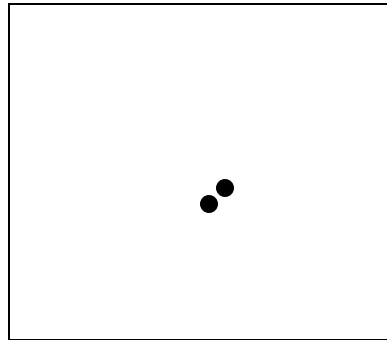
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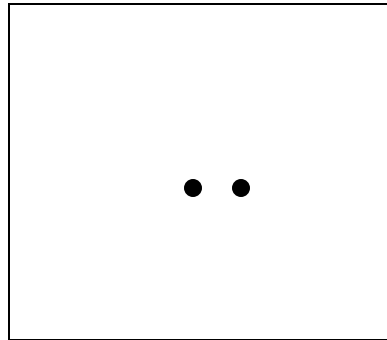
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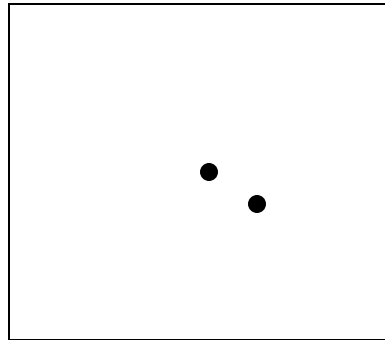
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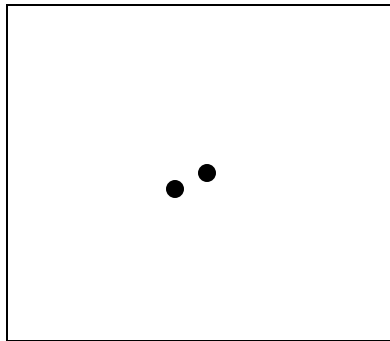
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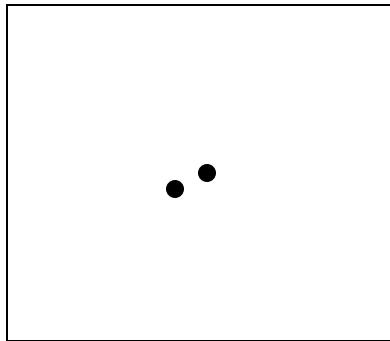


Direction of film is not clear

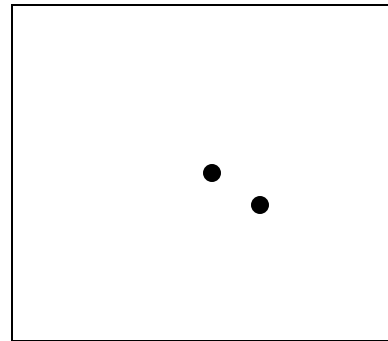
* *p. 157, Fabric of the Cosmos, B. Greene*



At Start



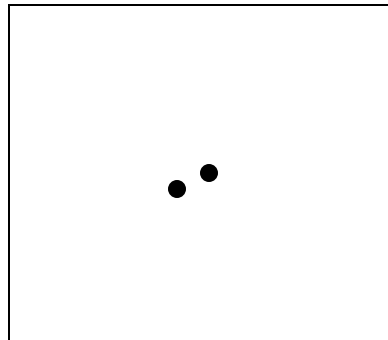
At Start



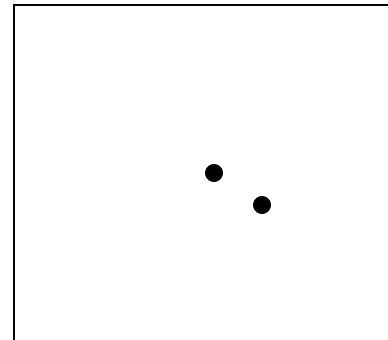
Some Time Later

Time appears to have no obvious direction

- for *small* number of constituents



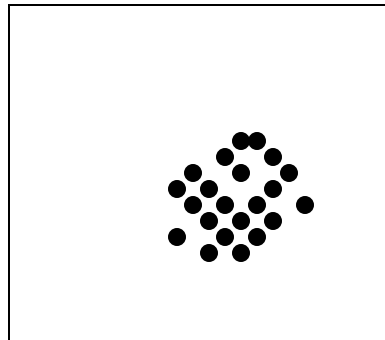
At Start



Some Time Later

Large Number of Constituents *

- A *huge* number of CO₂ molecules placed together in small box
 - Molecules become more and more uniformly spread out
 - Achieving higher and higher entropy

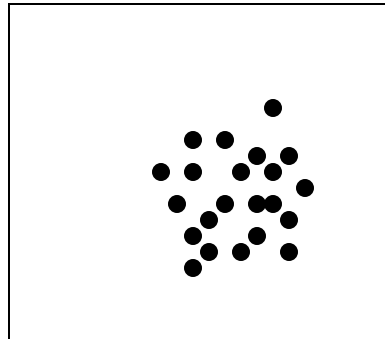


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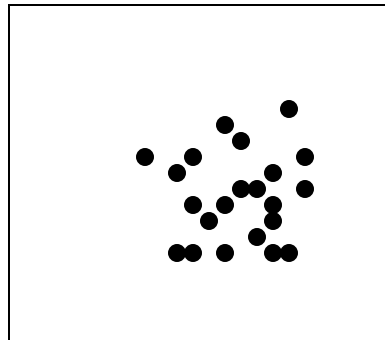
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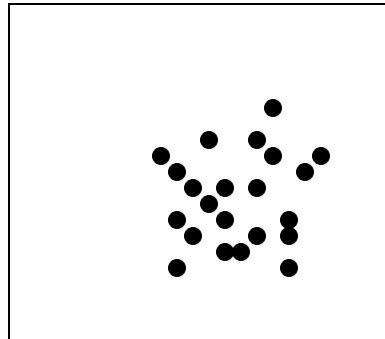
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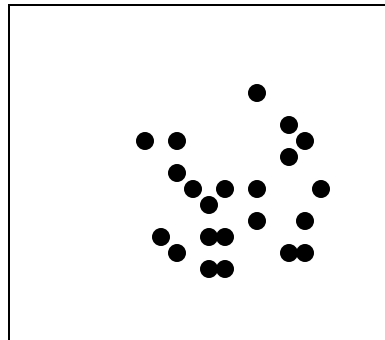
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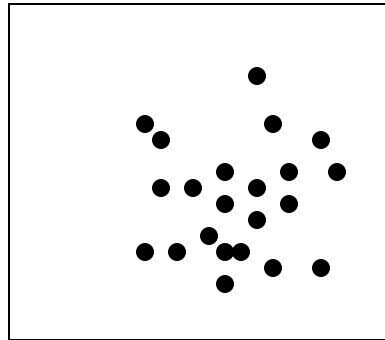
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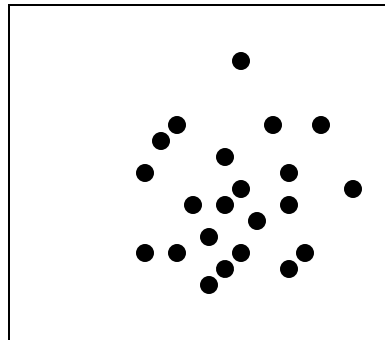
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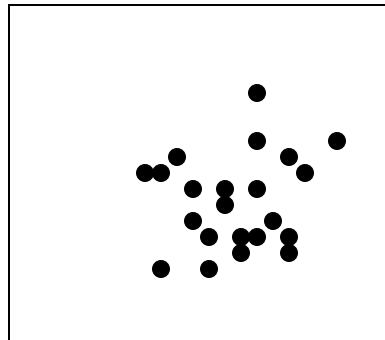
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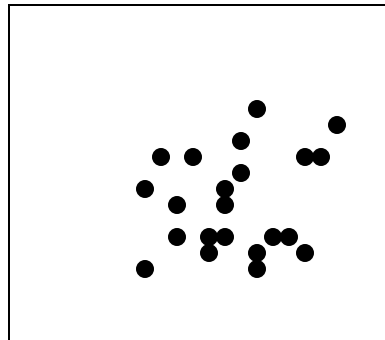
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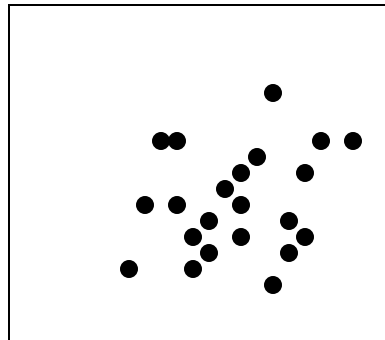
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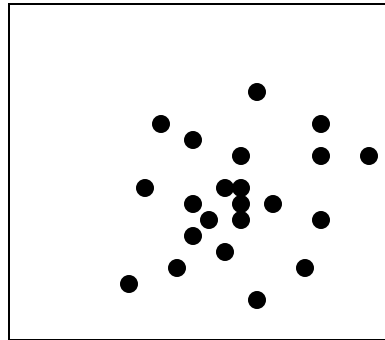
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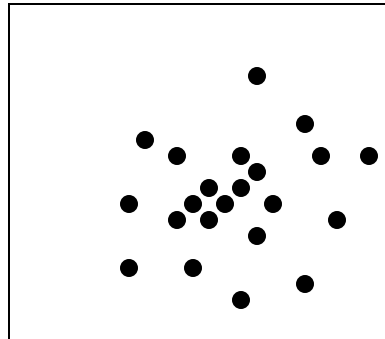
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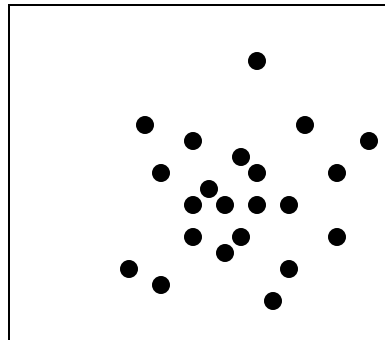
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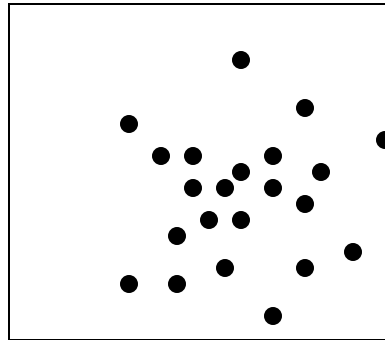
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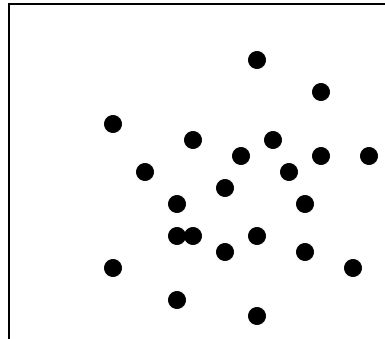
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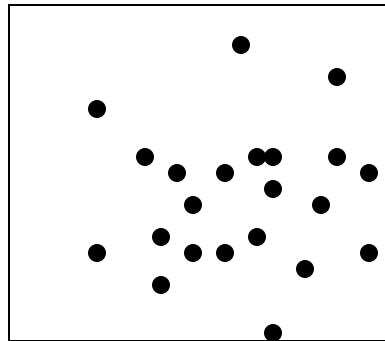
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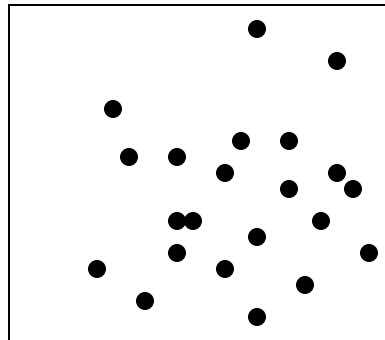
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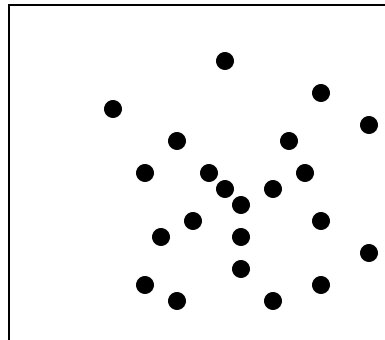
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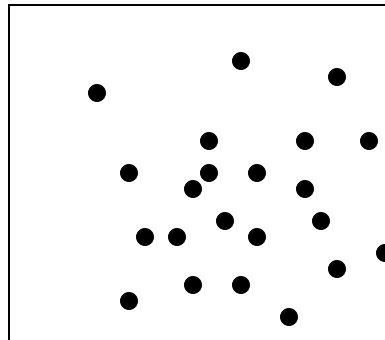
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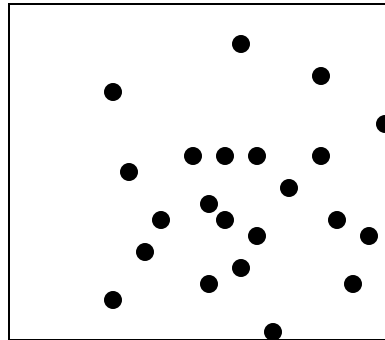
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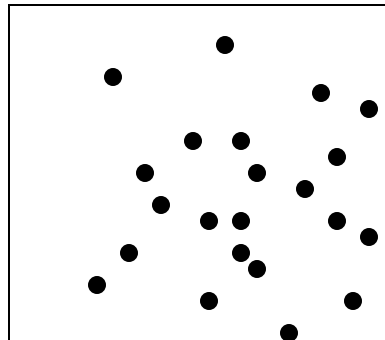
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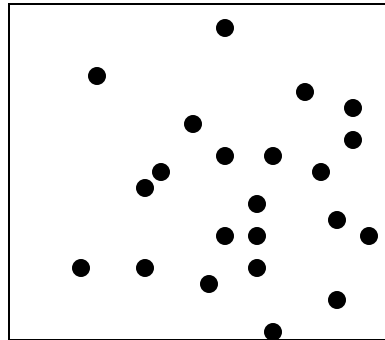
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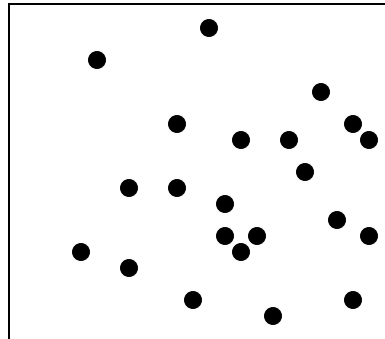
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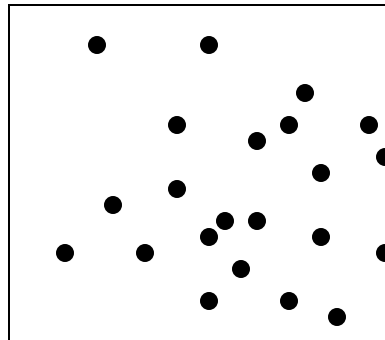
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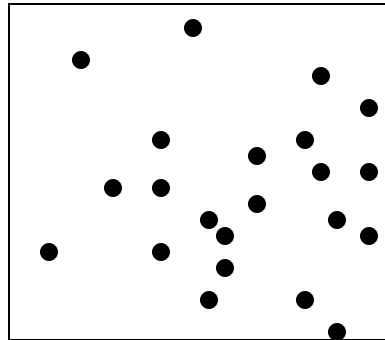
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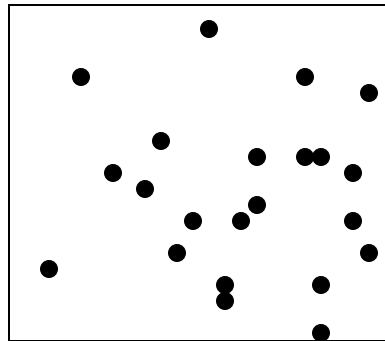
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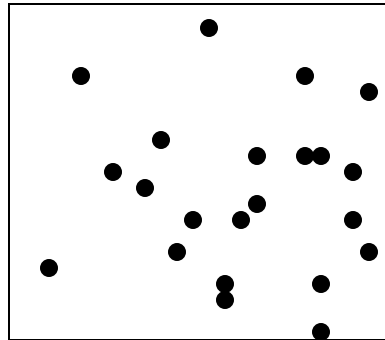
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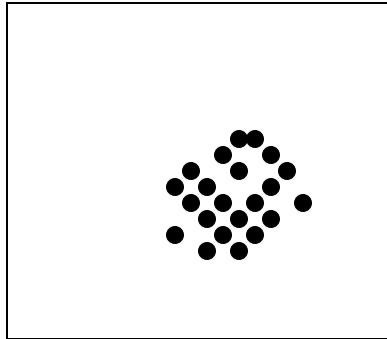
Easy to say whether film running forward or in reverse !

* p. 157, *Fabric of the Cosmos*, B. Greene

Overwhelmingly likely that in forward time direction

- Molecules become more and more uniformly spread out

- Achieving higher and higher entropy !

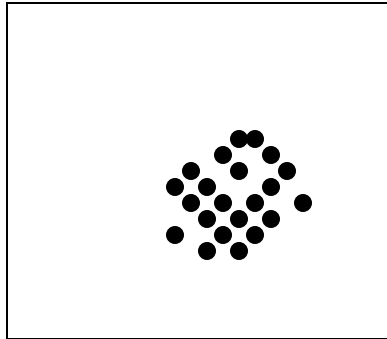


At Start

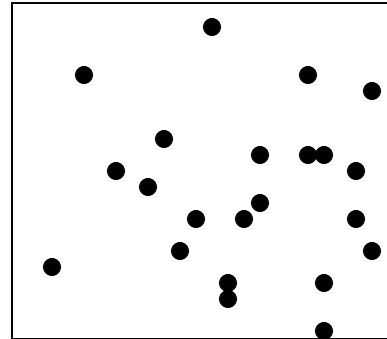
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At Start



Some Time Later

The behavior of a few constituents show no clear direction for time

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The behavior of *many* constituents does indicate a definite *direction for time* !

The behavior of a few constituents show no clear direction for time

The behavior of *many* constituents does indicate a definite *direction for time* !

We live in a world of many, many constituents (particles, atoms, molecules, etc.)

The behavior of a few constituents show no clear direction for time

The behavior of *many* constituents does indicate a definite *direction for time* !

We live in a world of many, many constituents (particles, atoms, molecules, etc.)

Is this why we see the forward flow of time?

End of Animation