

## **Gravity, Complexity and Time's Arrows**

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My talk (based on arXiv: 1310.5167 [gr-qc]) will draw attention to a hitherto unnoticed way in which scale-invariant notions of complexity and information can be defined in the problem of  $N$  point particles interacting through Newtonian gravity. In accordance with these definitions, all generic solutions of the problem with nonnegative energy divide at a uniquely defined point into two halves that are effectively separate histories. They have a common 'past' at the point of division but separate 'futures'. In each half, the arrow from past to future is defined by growth of the complexity and information. All previous attempts to explain how time-symmetric laws can give rise to the various arrows of time have invoked special boundary conditions. In contrast, the complexity and information arrows are inevitable consequences of the form of the gravitational law and nothing else. This leads to a notion of causality that could impact on discussion of the Bell inequalities. General relativity shares key structural features with Newtonian gravity, so it may be possible to obtain similar results for Einsteinian gravity.