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Abstract for an Invited Paper  
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**Exploring the universe with artificial intelligence**

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Astrophysics suffers from an extreme case of time scale mismatch between human lives ( $1e2$  years) to galaxies ( $1e8-9$  years), making experiments impractical. In order to build a physics-based account of how galaxies formed and evolved, we need to be able to forward model the processes involved. I will present some of the ways in which my group attempts to do this using generative models. These models allow us to explore how astrophysical objects change in a data-driven way. I will also show how we can use techniques from machine learning to extract more information from existing data, and how we can use reinforcement learning to better run and exploit observational facilities.