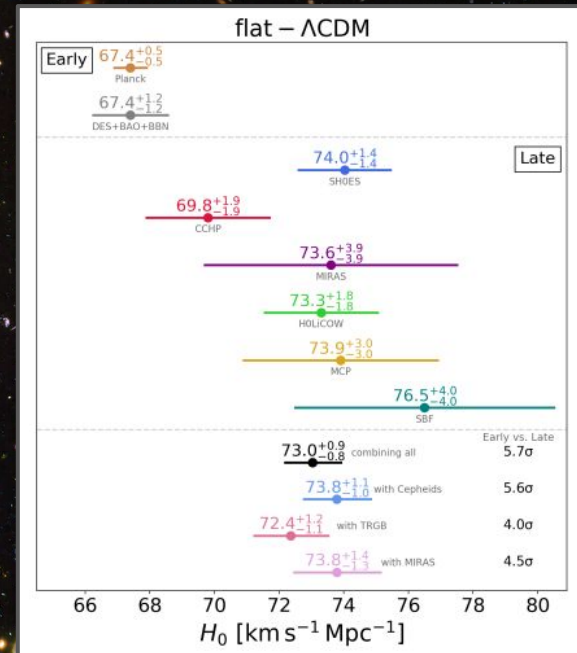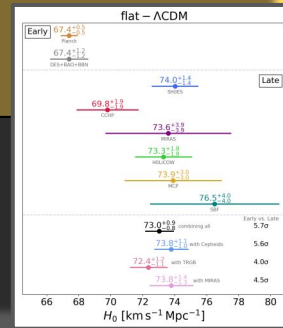# Cosmological inference using gravitational waves and normalizing flows

By Federico Stachurski
Flash Talk - EuCAIFCon 2025
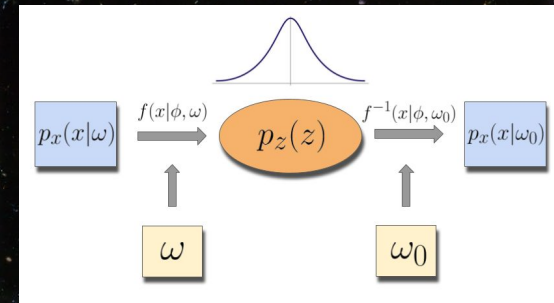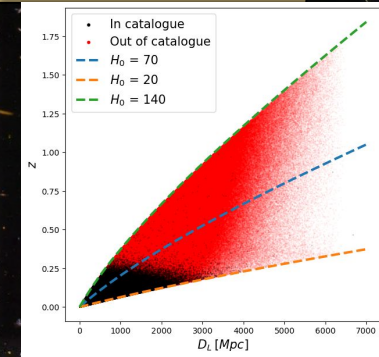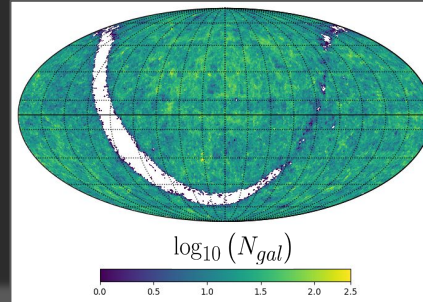

[Vivien Bonvin and Martin Millon]

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- *Introduction*: Recent experiments show inconsistency between late type and ealy type universe rate of expansion (H0), around 5σ, maybe can be resolved with Gravitational Waves.
- *Problem*: Traditional well accepted Bayesian pipelines may struggle with surge of events in O4 - O5 detector observing runs, likelihood can be expensive. More flexibility in the analysis to expand the dimensionality of the parameter space we are interested in.
- *Solution*: Machine Learning (ML). What model? Normalizing Flows (NF).
- *How to?*: Simulation based. Train a conditional NF over data points representing GWs from different cosmologies. With the likelihood modelled by the NF, likelihood becomes much cheaper. Scales well with number of events, so more direct science!
- *Future Work*: endless capabilities, high flexibility in simulating all sorts of events from many different type of cosmologies and even beyond GR cosmologies? Who knows!

$$H_0 \approx \frac{cz}{D_L}$$

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