

# Theory, observation & cosmological inference

Introduction to KICC: 5 minutes on Will Handley's research

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[willhandley.co.uk/talks](http://willhandley.co.uk/talks)

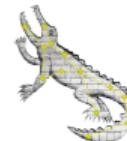
7<sup>th</sup> December 2022



**The  
Alan Turing  
Institute**



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# Research overview

## Theory

- ▶ Early universe cosmology
- ▶ Modified gravity

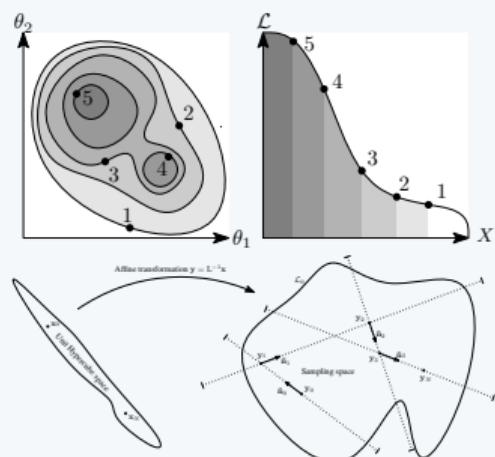
## Inference

- ▶ Nested sampling
- ▶ Likelihood free inference

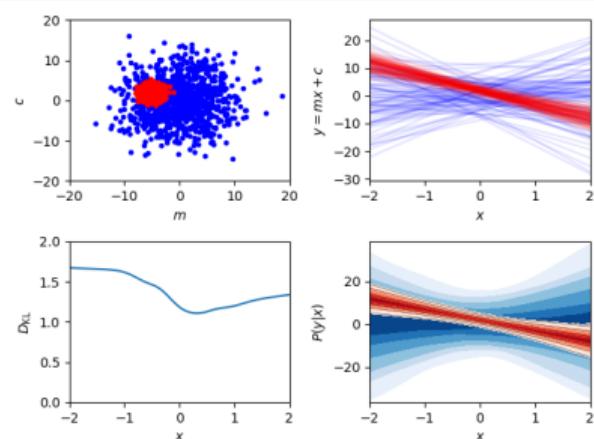
## Observation

- ▶ REACH
- ▶ GAMBIT

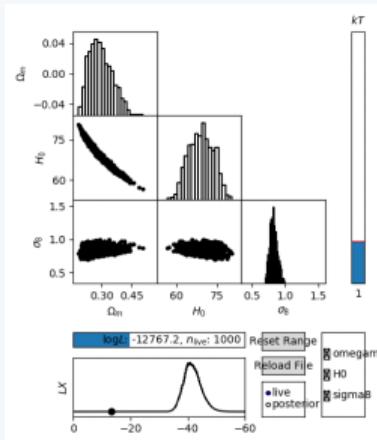
## PolyChord



## fgivenx



## anesthetic



Coming soon: unimpeded, supernest

# Theory of the primordial and late-time universe



**Metha Prathaban** (PhD1)

Palindromic & two-sheeted universes – boundary conditions & Boltzmann solvers.



**Wei-Ning Deng** (PhD1)

Primordial curvature & comoving curvature perturbations  $\mathcal{R}$ .



**Sinah Legner** (PhD1)

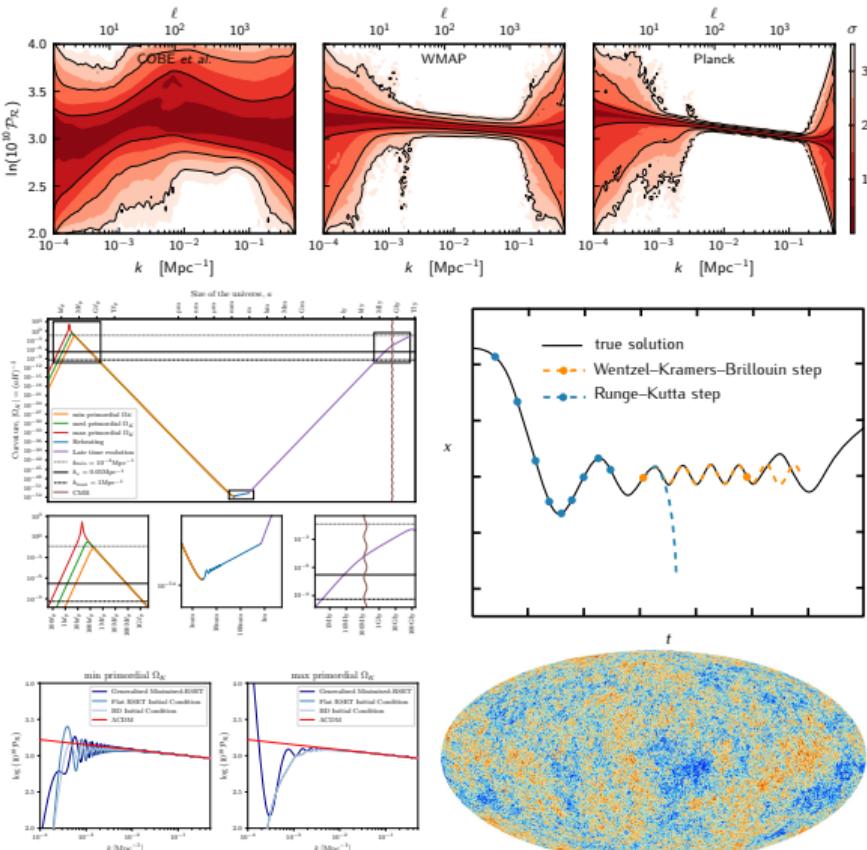


Predictions & perturbations from gravitational gauge-theories.

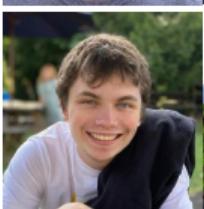
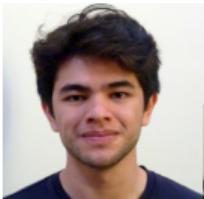


**Danielle Dineen** (MPhil)

Israel junction conditions and potential-independent predictions from inflation.



# Observation: REACH & GAMBIT



**Ian Roque** (PhD4)

Bayesian radiometer calibration  
for the REACH radio telescope.

**Thomas Gessey-Jones** (PhD3)

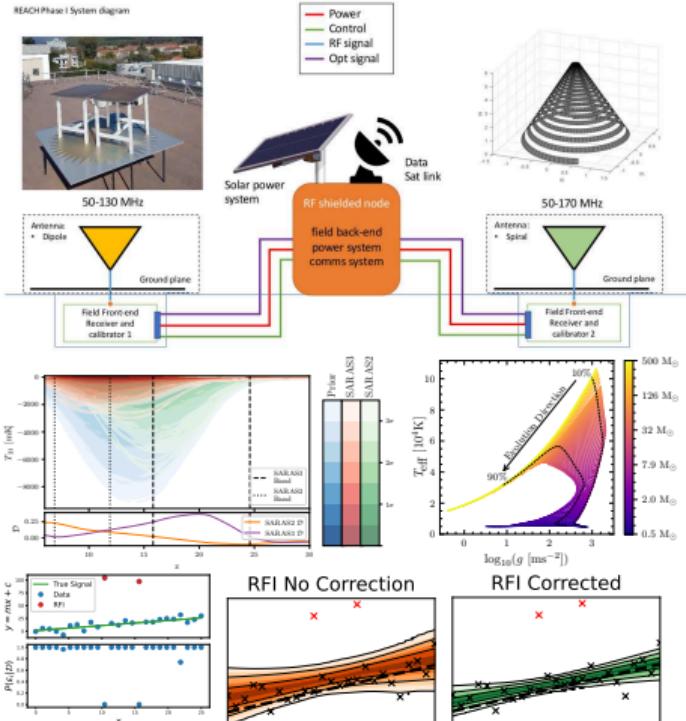
REACH 21cm universe theory:  
Pop III stars & cosmic rays.

**Harry Bevins** (PhD4)

21cm data analysis and  
machine learning: margarine,  
maxsmooth & globalemu.

**Sam Leeney** (MPhil)

Bayesian RFI excision for  
REACH and pulsars.



# Inference: Nested sampling and Bayesian machine learning



**Adam Ormondroyd** (PhD2)  
Cosmic history reconstructions,  
clustering in nested sampling.



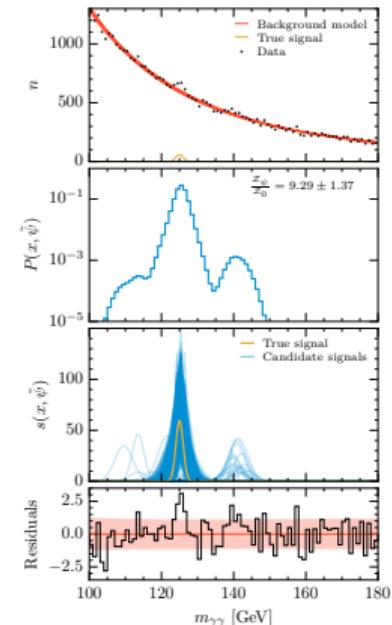
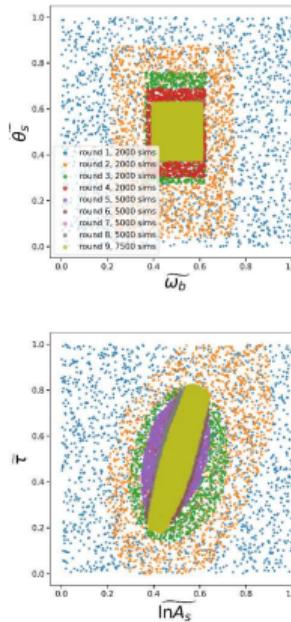
**Kilian Scheutwinkel** (PhD2)  
Likelihood-free inference and  
nested sampling



**George Carter** (PhD3)  
Bayesian global sky modelling



**Sahibzada Allahyar** (MPhil)  
High-precision nested sampling,  
gravitational wave astrometry.



**David Yallup** (PostDoc)  
Bayesian Neural Nets,  
sparse reconstruction,  
& Gaussian Processes