

Efficient Parameter Space Exploration in BSM Theories

with Batched Multi-Objective Constraint Active Search

Physics and Astronomy

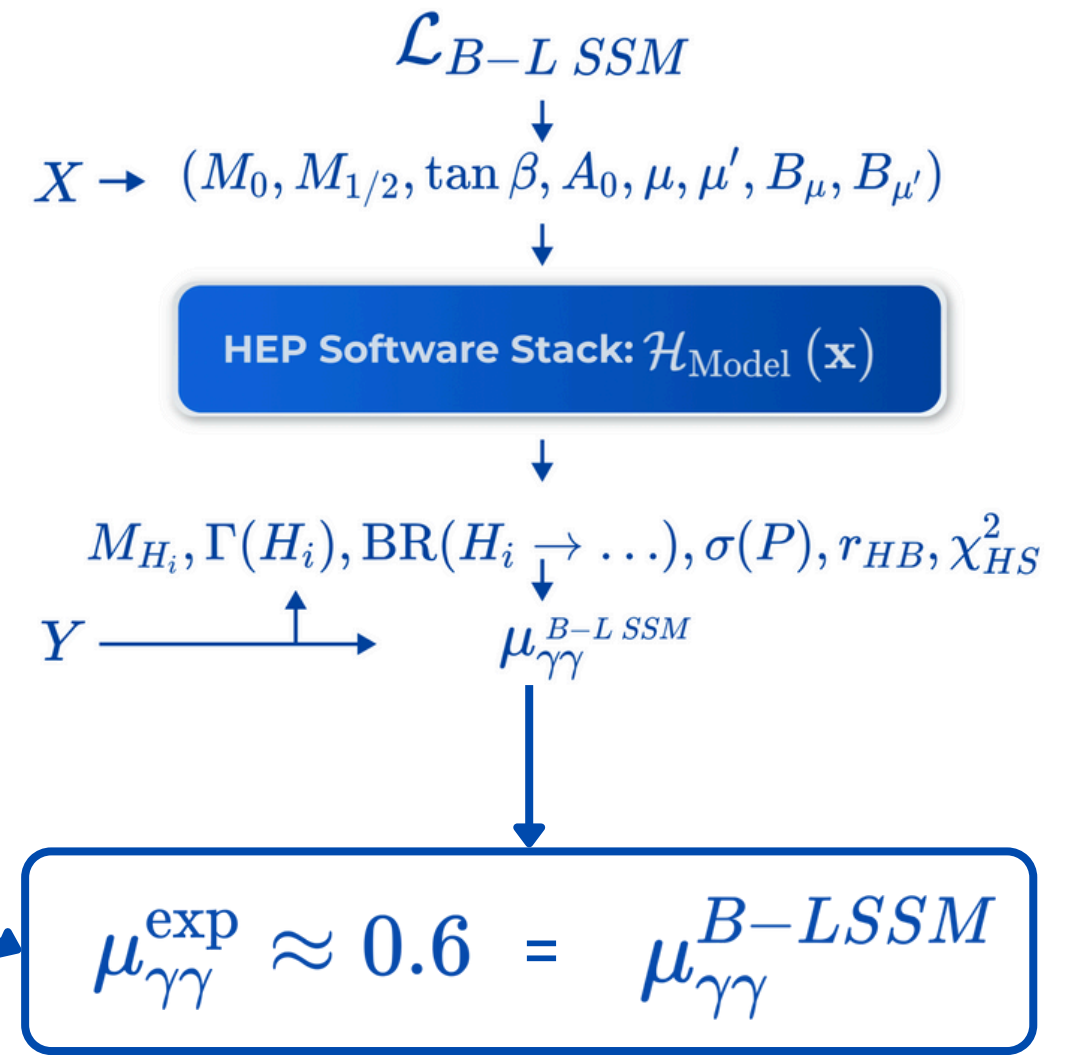
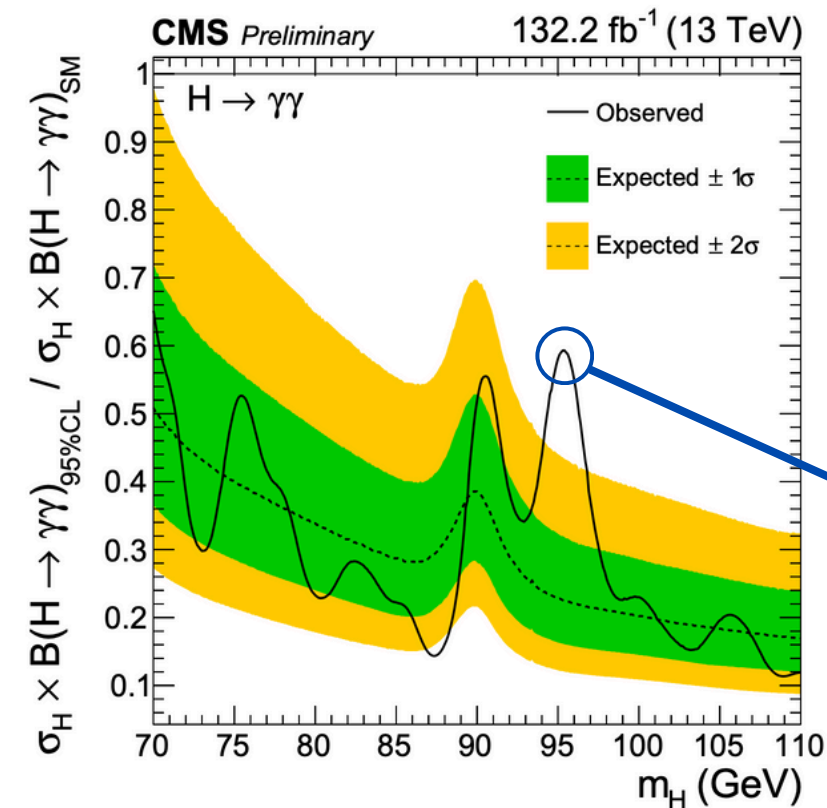
Electronics and Computer Science



Mauricio A. Diaz, Giorgio Cerro, Stefano Moretti, Srinandan Dasmahapatra.

Several hints of new physics exist, and more are emerging:

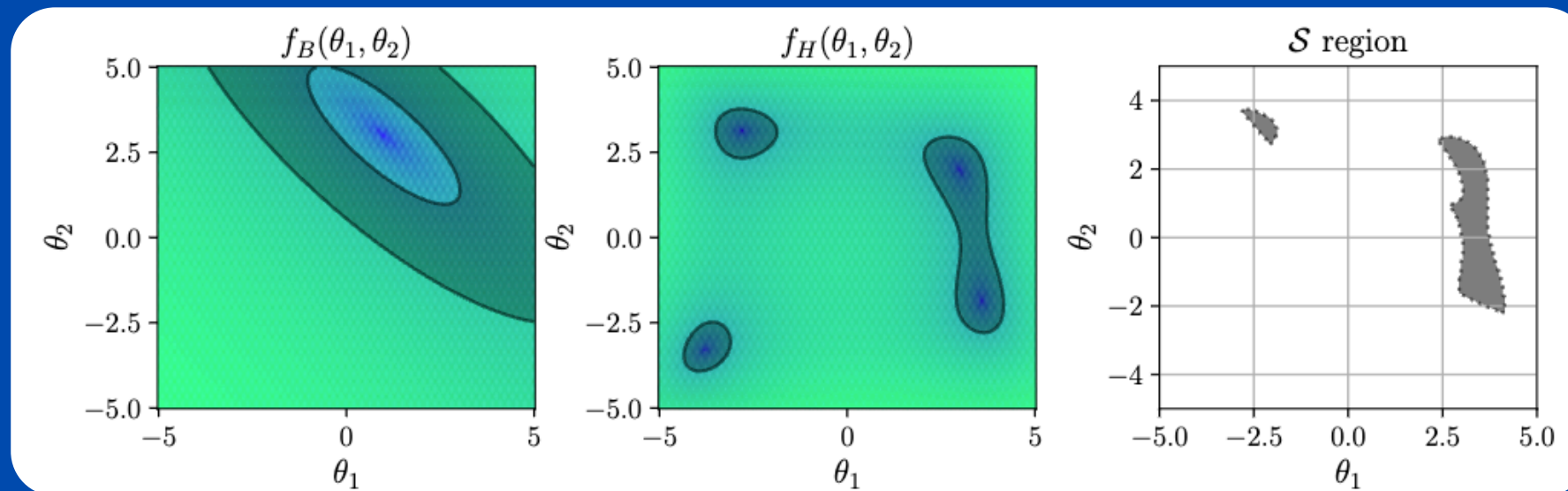
- **Neutral Scalars**
- Flavour anomalies
- Neutrino masses
- Dark matter



PARAMETER SPACE SCANS

Parameter scan methods aim to identify a set of points that belong to a rare category defined by constraints

$$\mathcal{S} = \{\mathbf{x} \mid \mathbf{y} = \mathcal{H}_{\text{Model}}(\mathbf{x}) \wedge y_i \in \tau_i\}$$



- Full \mathcal{S} characterisation
- Diverse and dense filling

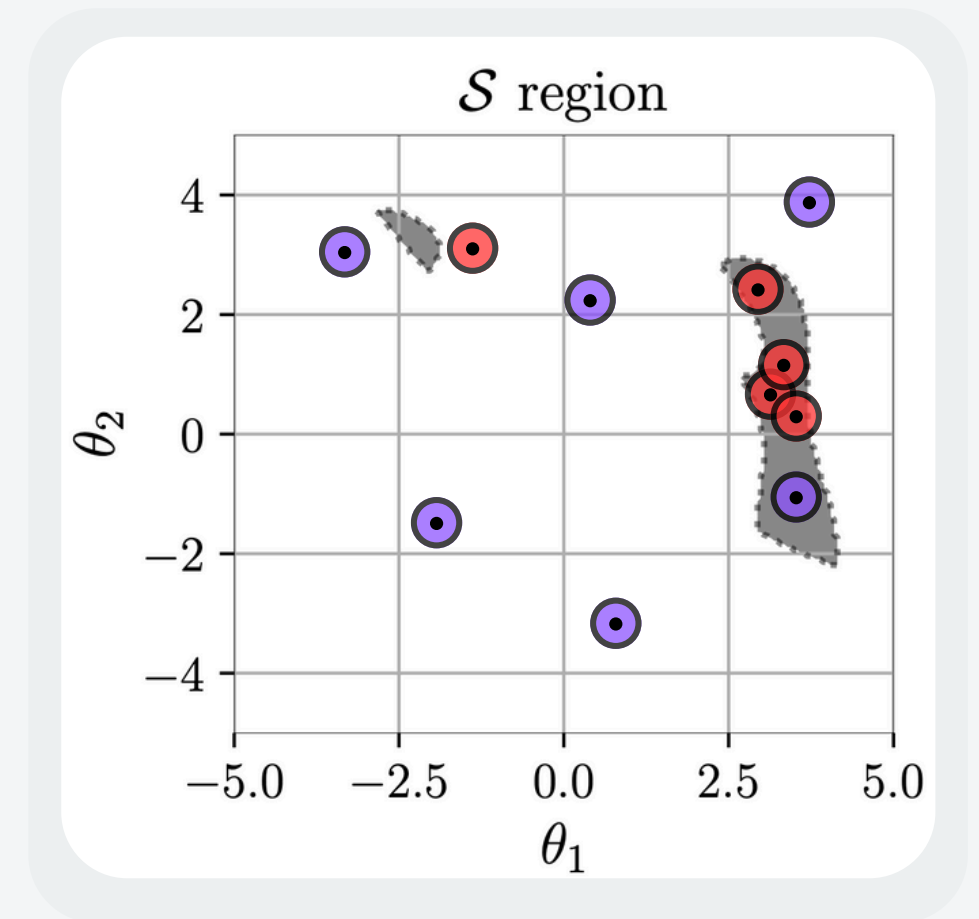
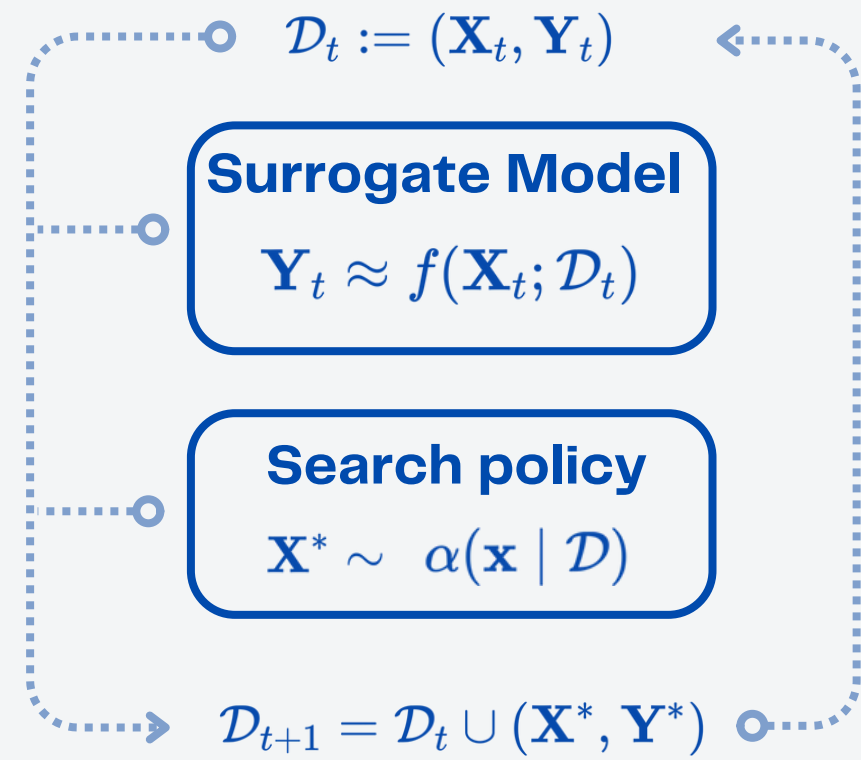
- \mathcal{S} region might be sparse and disconnected
- $\mathcal{H}_{\text{Model}}(\mathbf{x})$ is expensive to evaluate

Active Search Formulation

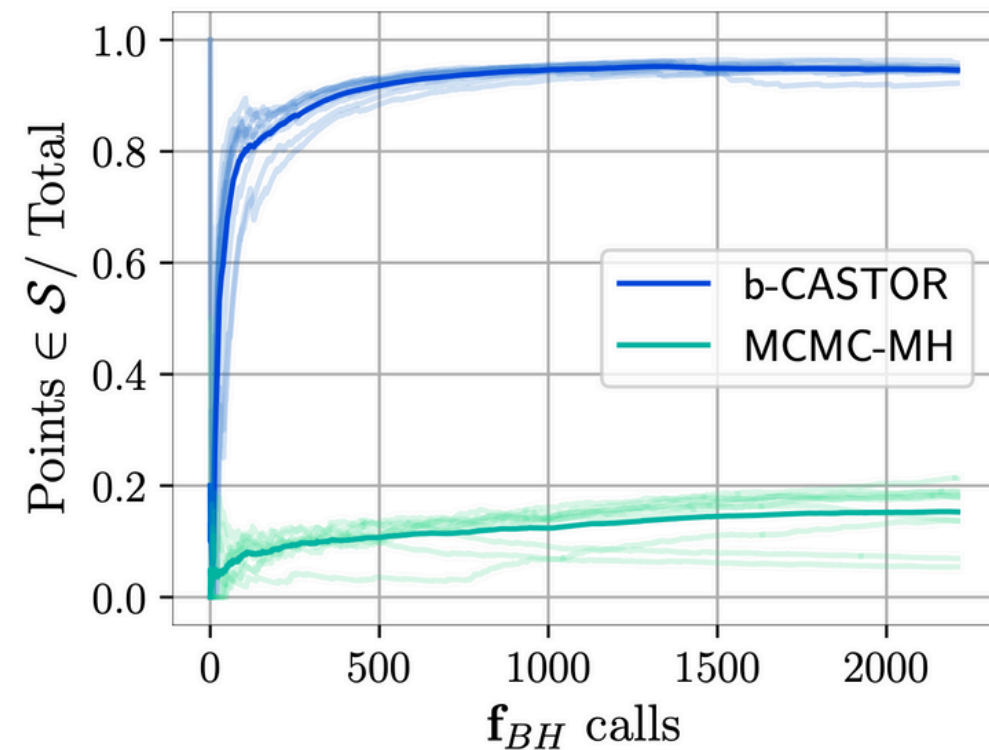
We introduce

b-CASTOR 

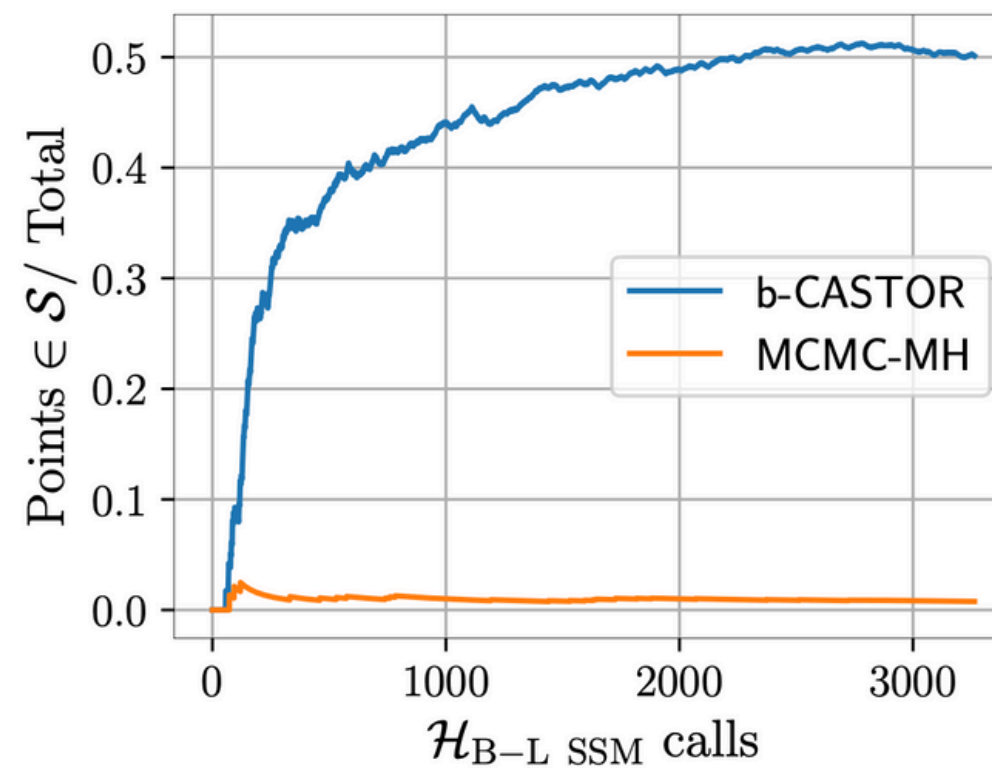
batched Constraint Active Search¹
with **TPE Optimisation** and **Rank based sampling**



Test Function: 2D Two Objectives



B - L SSM study: 8D Five-Objectives



A 27

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Particle Physics Phenomenology

Parameter Space Scans

b-CASTOR

CONCLUSION

FUTURE

Mauricio A. Diaz, George Chin, Stefano Moretti, Alexander Dorschner

1. G. Malkomes, B. Cheng, E.H. Lee and M. Mccourt, Beyond the pareto efficient frontier: Constraint active search for multiobjective experimental design