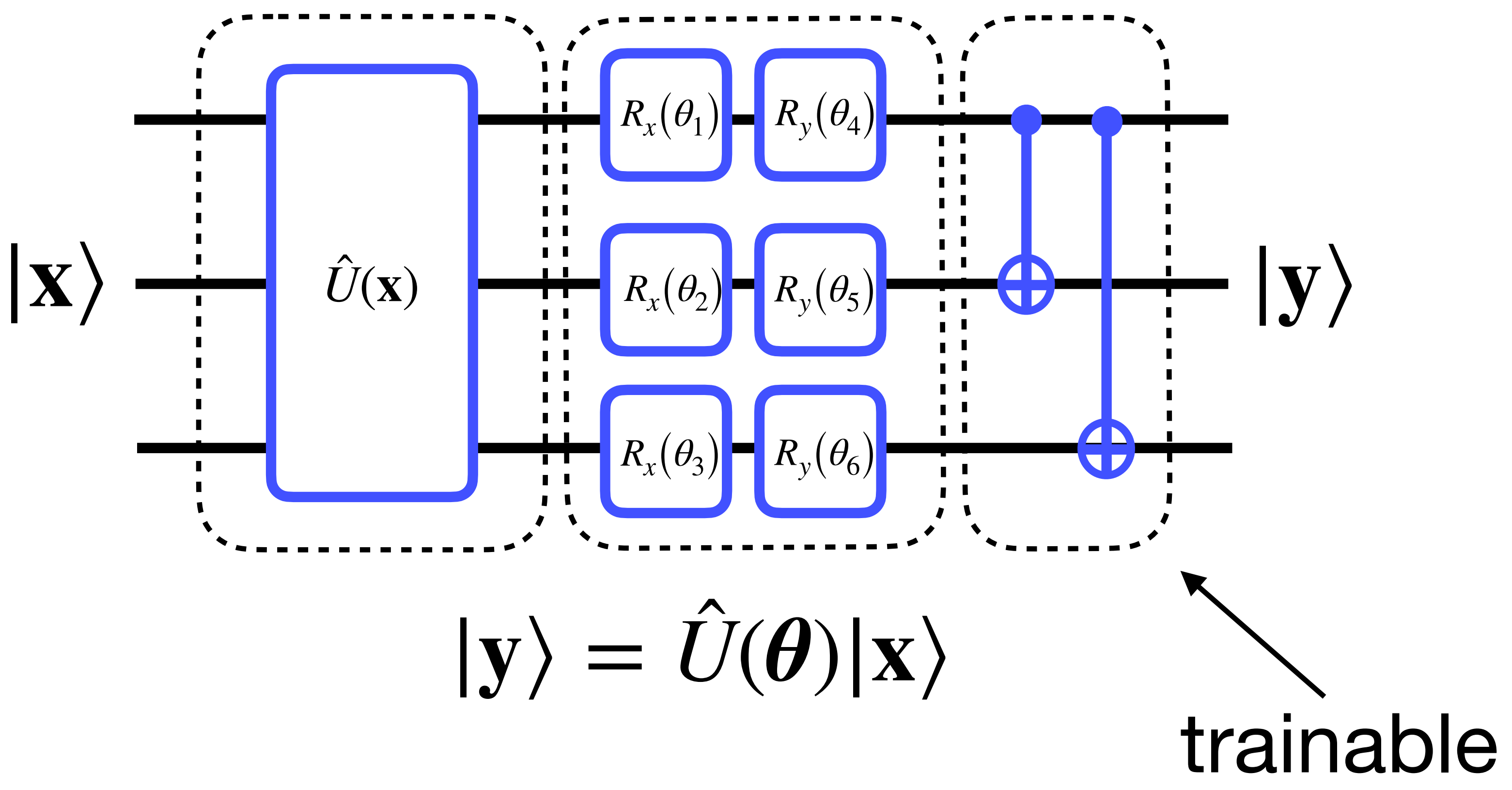
Poster stand 33

Quantum diffusion model: ingredients

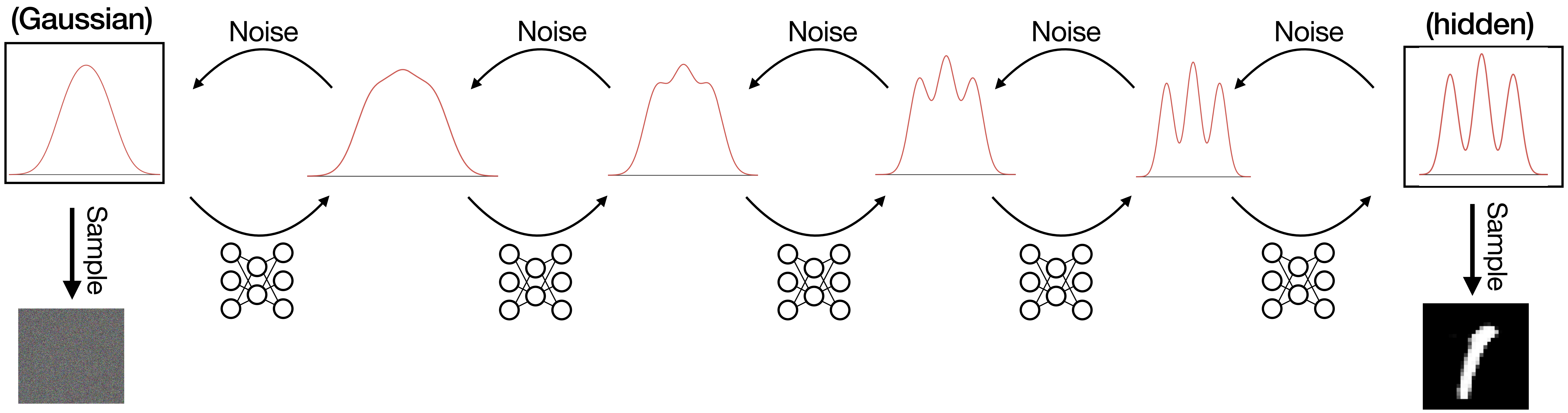
- **Generative model**: learn hidden distribution from samples
- **Diffusion model**: connect target distribution to Gaussian through Markov chain
- **Quantum neural network**: trainable transformation on quantum states

Quantum neural network



$$|\mathbf{y}\rangle = \hat{U}(\boldsymbol{\theta})|\mathbf{x}\rangle$$

Classical diffusion model



"Quantum diffusion models" - Andrea Cacioppo, Lorenzo Colantonio, Simone Bordoni, Stefano Giagu

Poster stand 33

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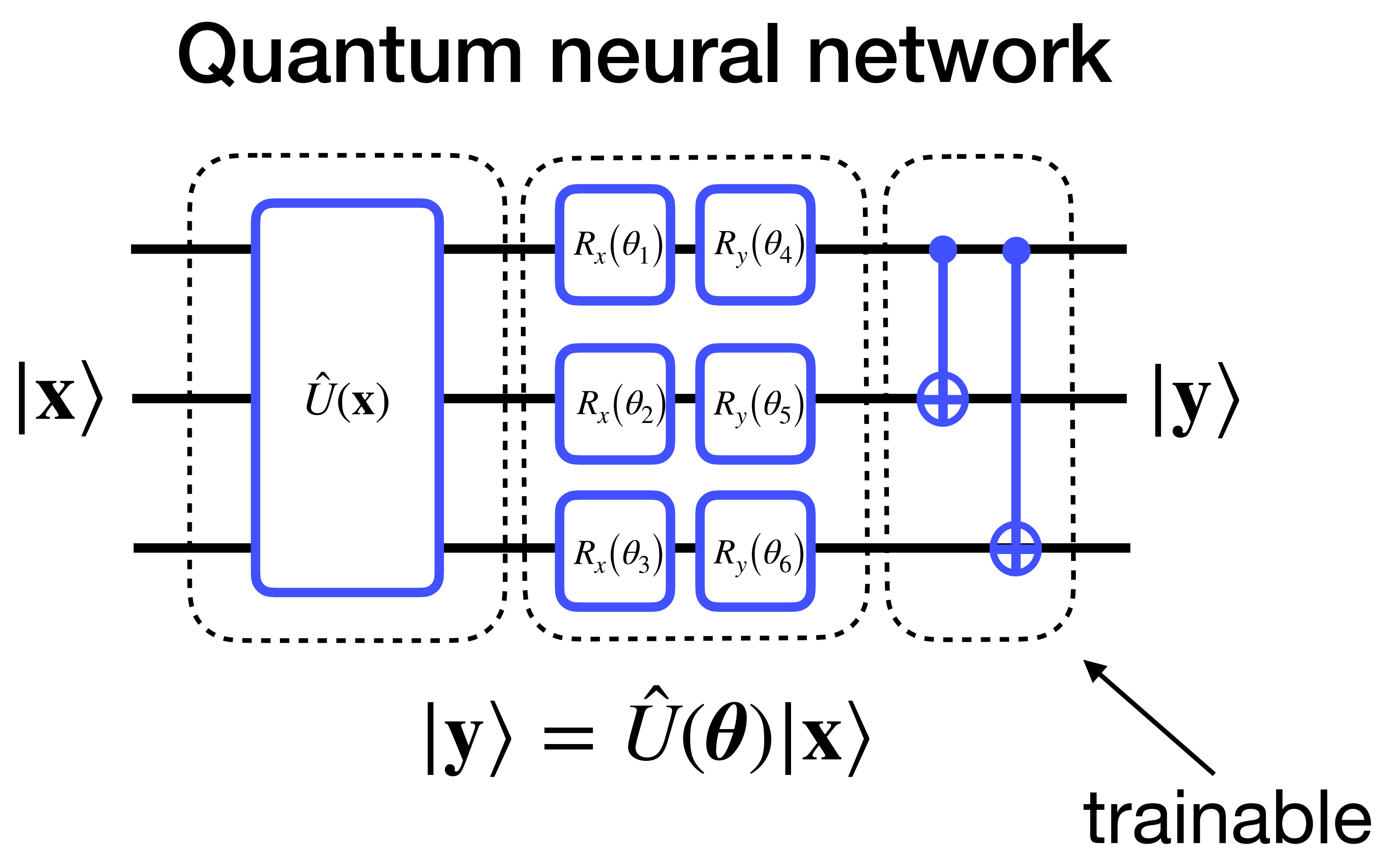
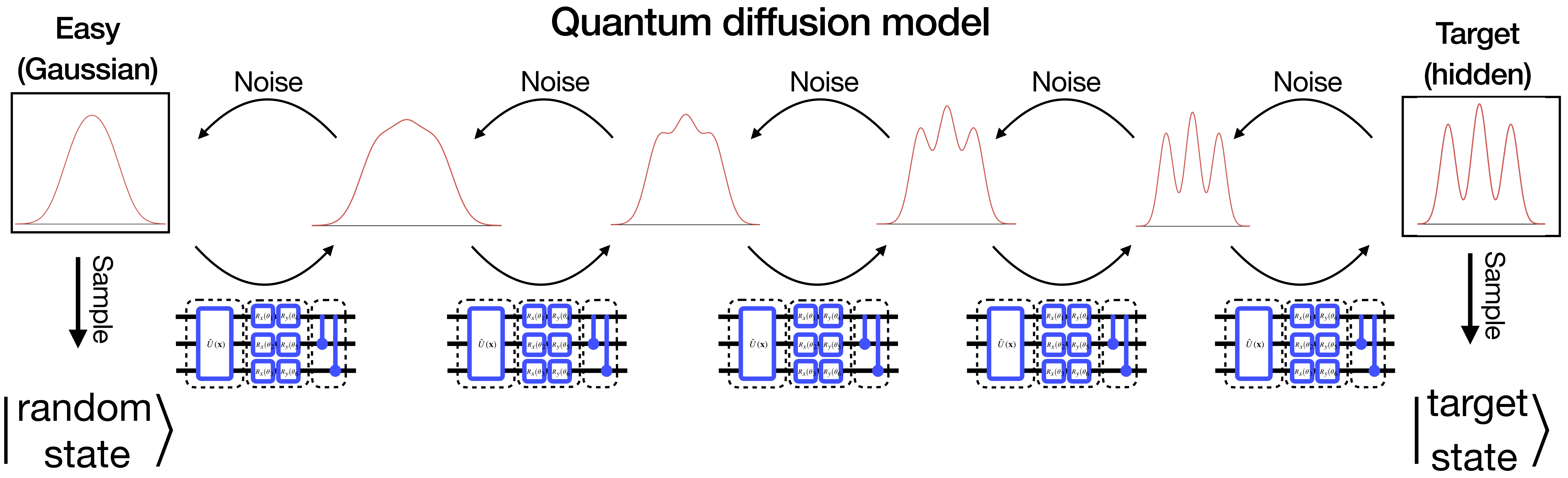


$$|\mathbf{y}\rangle = \hat{U}(\boldsymbol{\theta})|\mathbf{x}\rangle$$



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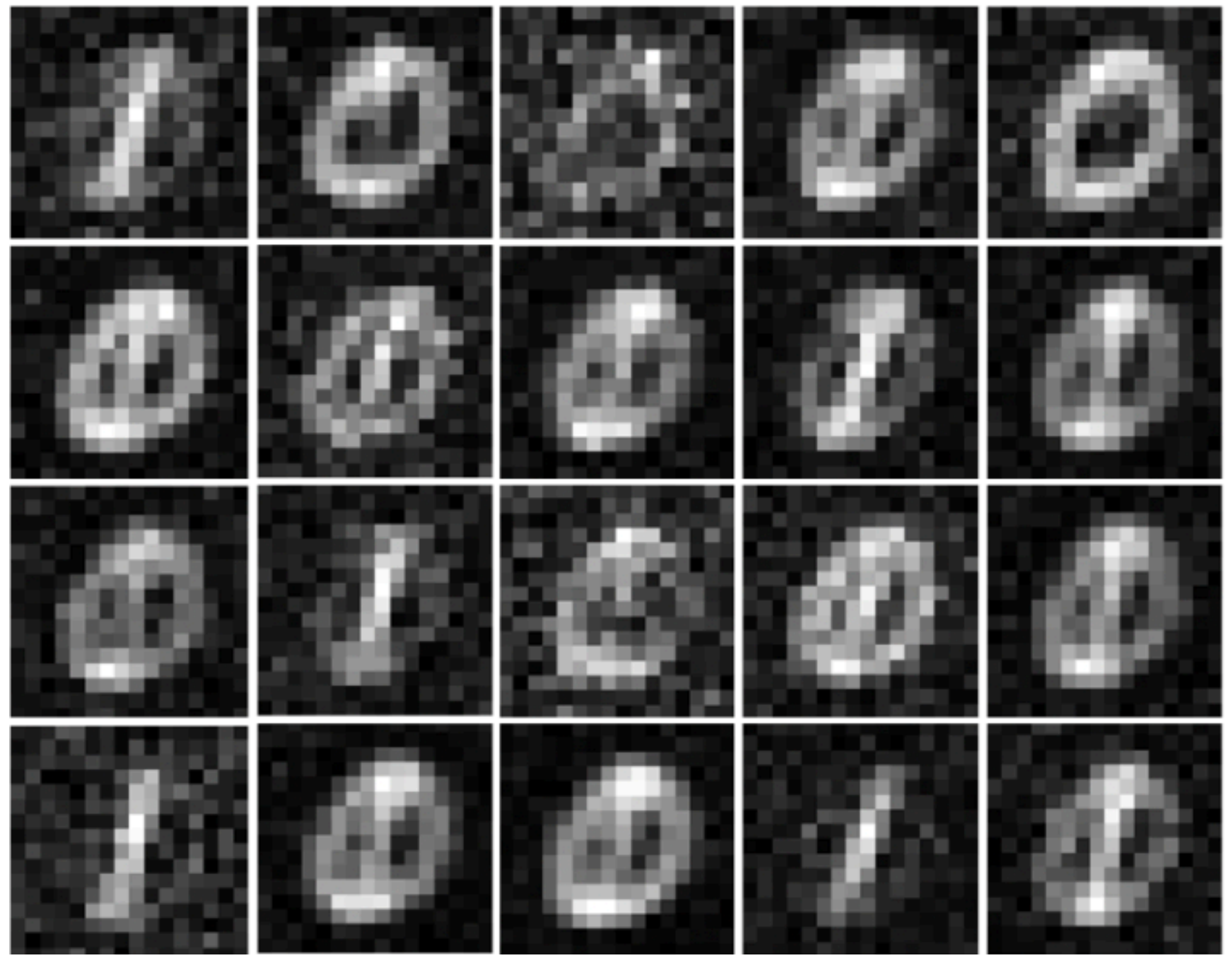
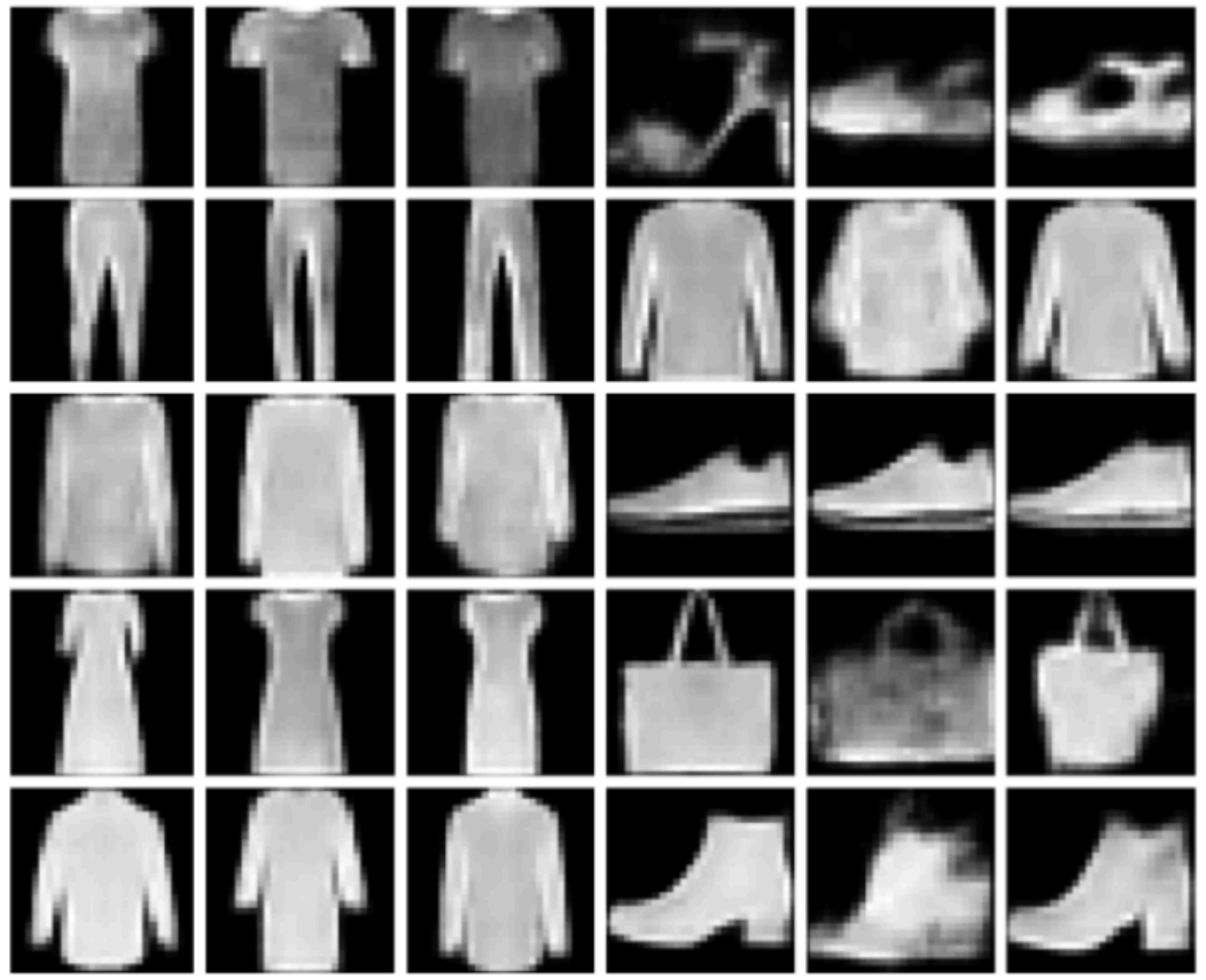
Poster stand 33

Learned distributions

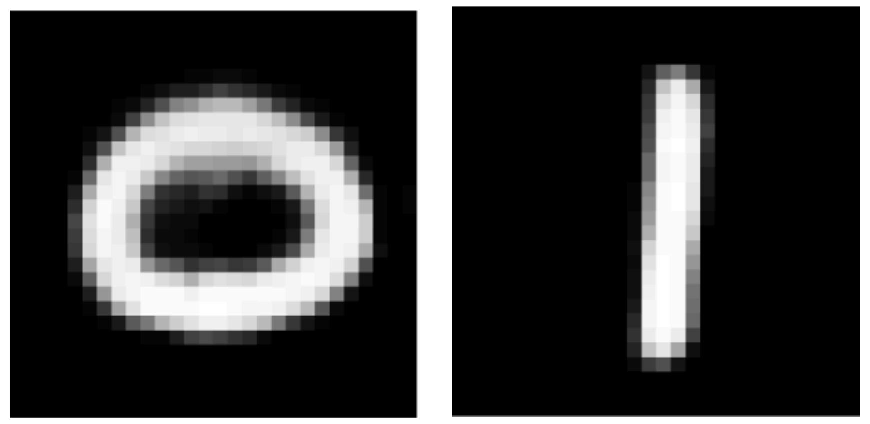
Quantum model (simulation)



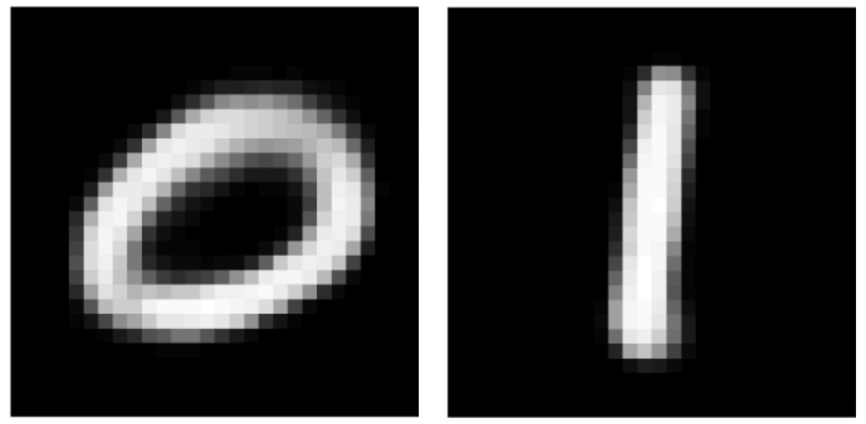
Quantum model (simulation) + Classical autoencoder



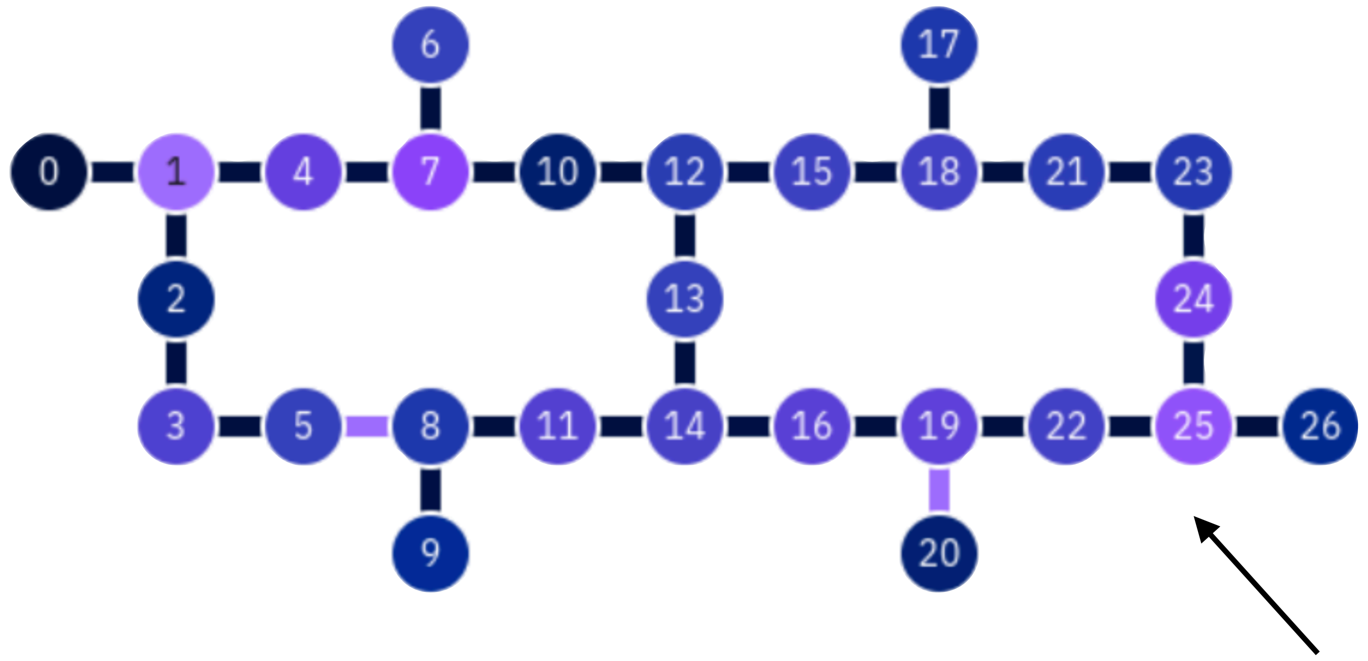
Quantum model (hardware) + Classical autoencoder



Simulated



Hardware



Quantum Chip
(IBM Hanoi)

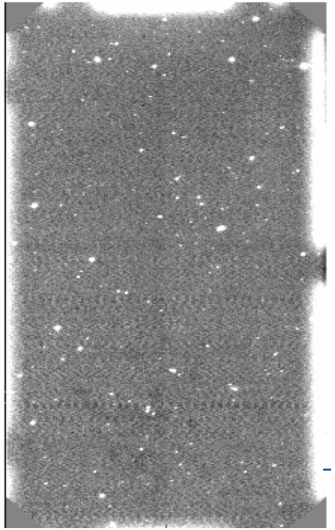
"Quantum diffusion models" - Andrea Cacioppo, Lorenzo Colantonio, Simone Bordoni, Stefano Giagu

MULTI-BAND PHOTOMETRY AND REDSHIFT ESTIMATION FROM GALAXY IMAGES WITH NORMALIZING FLOWS

Laura Cabayol-Garcia (IFAE/PIC, Barcelona)

Cosmological analysis demands precise 3D mapping of the Universe

Measuring distance to galaxies (redshift)



Photometry

Several steps:
- Background subtraction
- Flux measurement
- Calibration
- ...

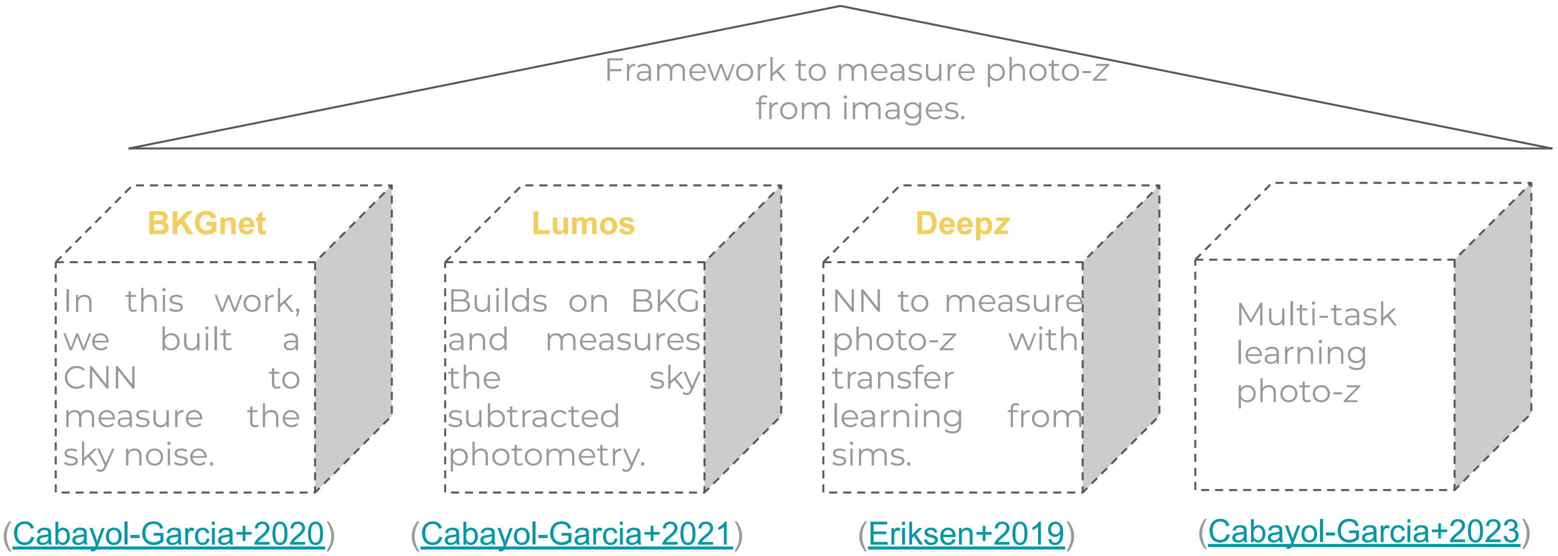
Photo-z

+photometry

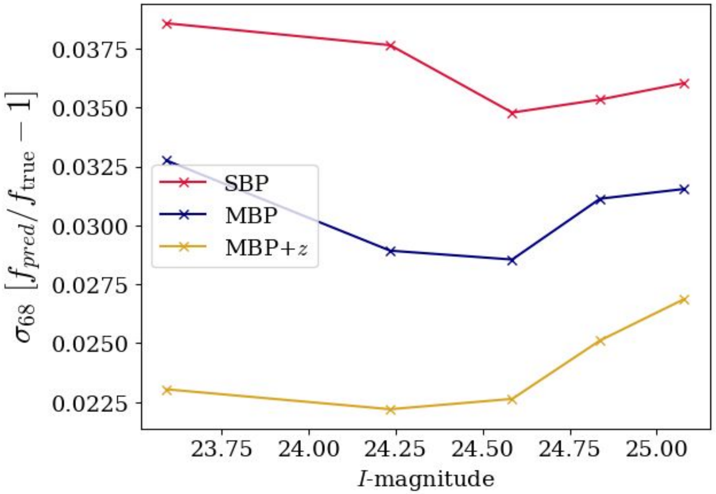
This work!

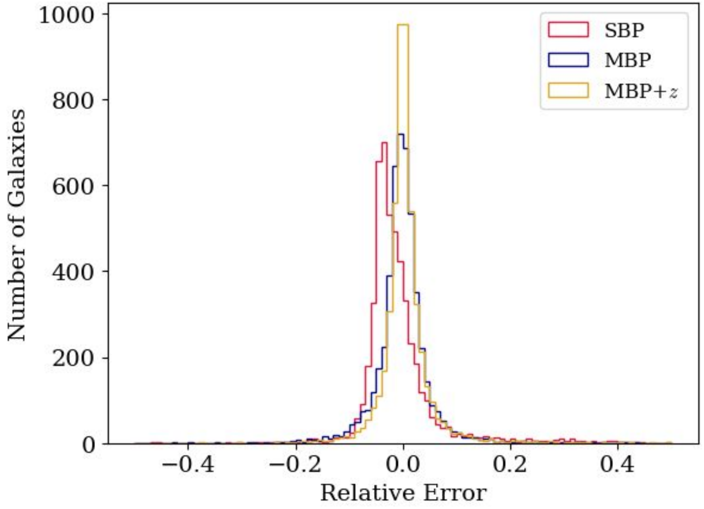
Bypassing the need for sequential measurements!!

Currently there are efforts on measuring photo-z directly from images with AI. **We are developing a normalizing flow model to concurrently measure photometry and photometric redshifts directly from the astronomical images.**



By simultaneously **measuring photometry across multiple spectral bands and photometric redshifts**, our model harnesses the full energy distribution of galaxies, which **enables cross-band constraints maximizing the use of information in the data.**





SBP: Single-band photometry. Each band is independent, the network does not learn from other bands to predict the flux of one band

MBP: Multi-band photometry. The network has information from all bands when making a prediction.

MBP+z: Multi-band photometry and redshift. The network has information from all bands when making a prediction. Predicts the photometry and the redshift simultaneously

The network benefits from knowing the full SED when making a prediction. It also benefits from predicting the photo-z simultaneously (MTL)

Check poster 36 tomorrow!

Kicking it Off(-shell)

with Direct Diffusion

Anja Butter,Tomas Jezo, Michael Klasen, Mathias Kuschick, Sofia Palacios Schweitzer, Tilman Plehn

arXiv: 2311.17175

Simulating leptonic $t\bar{t}$ decays precisely = Include off-shell processes

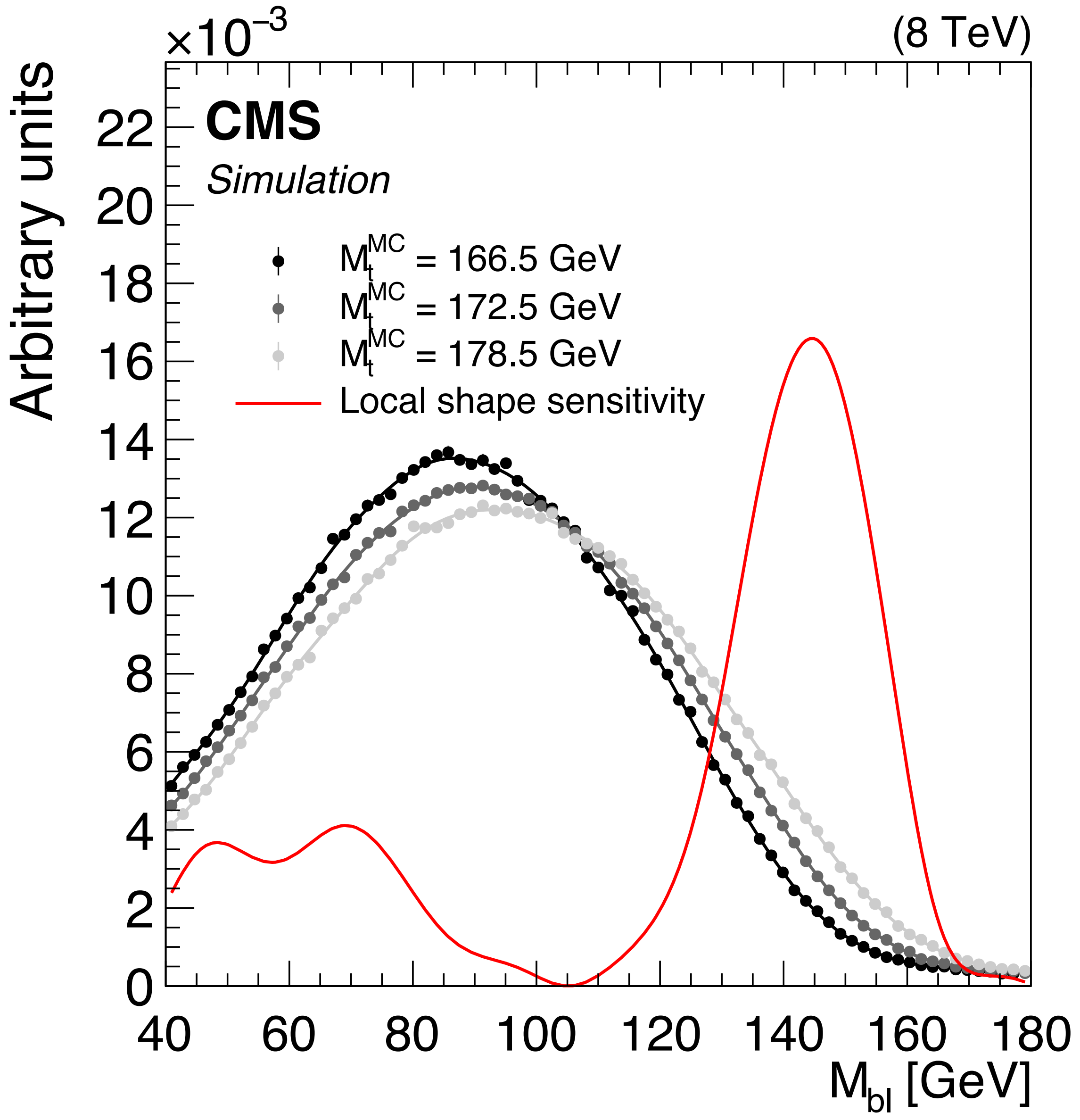
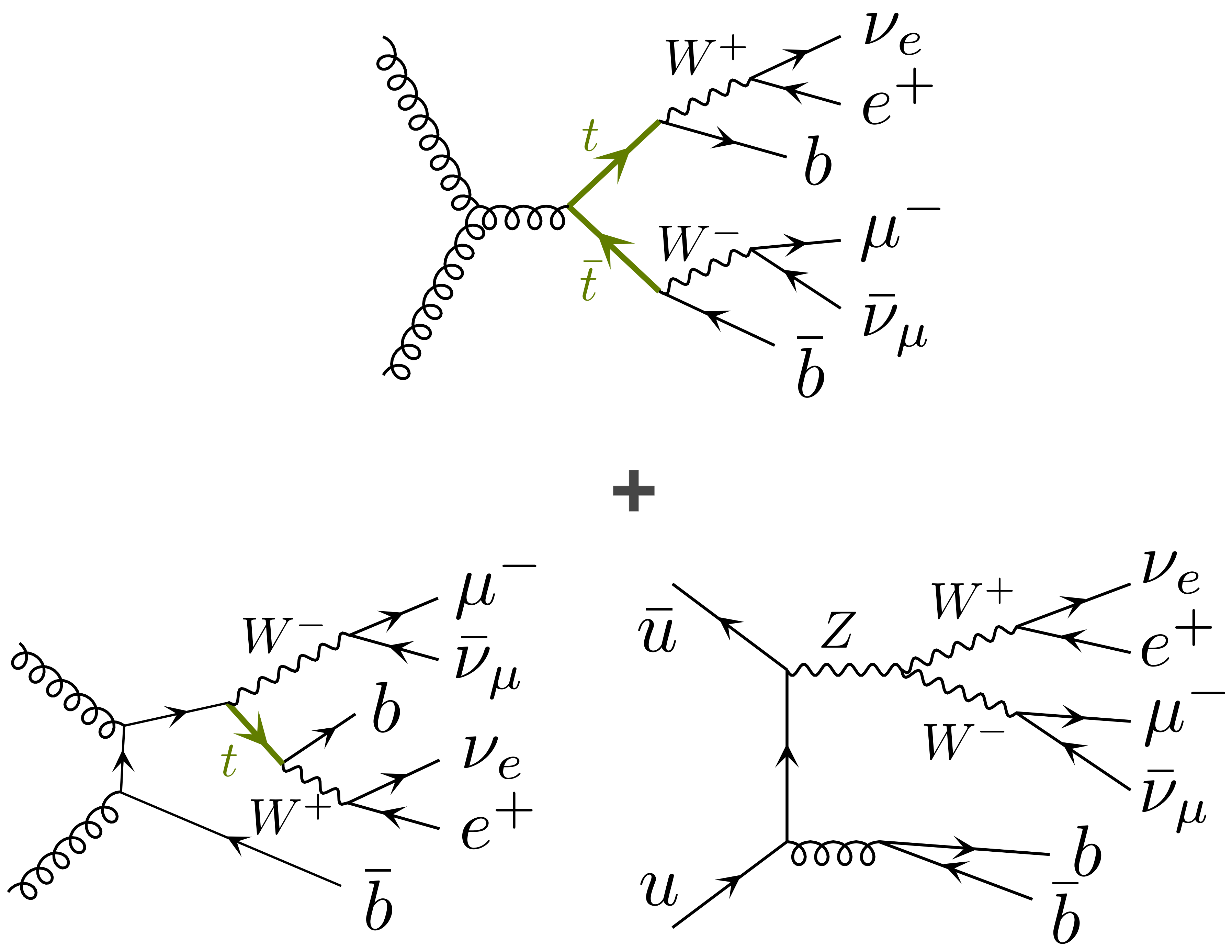


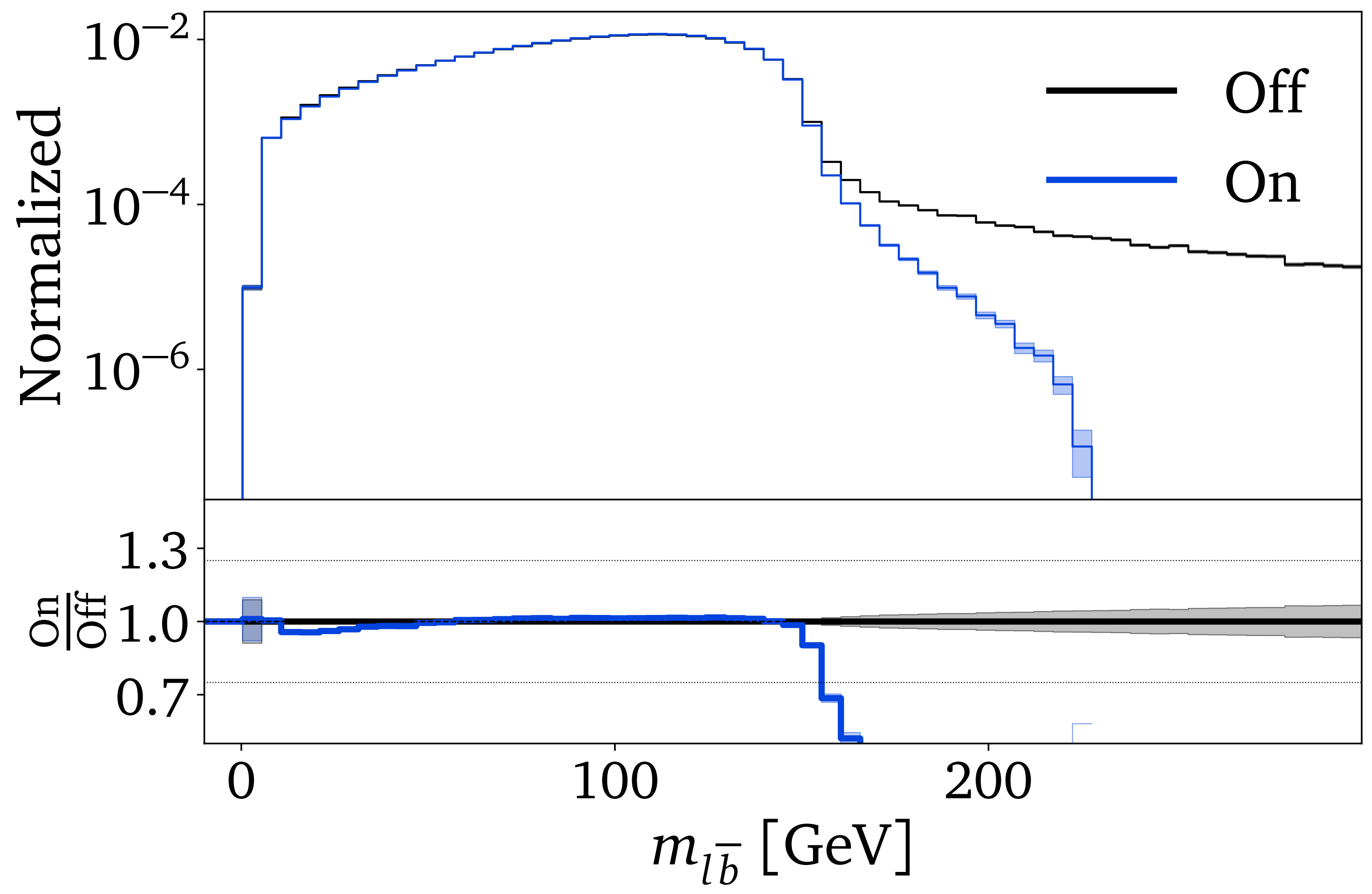
Figure from CMS arXiv:1704.06142v2

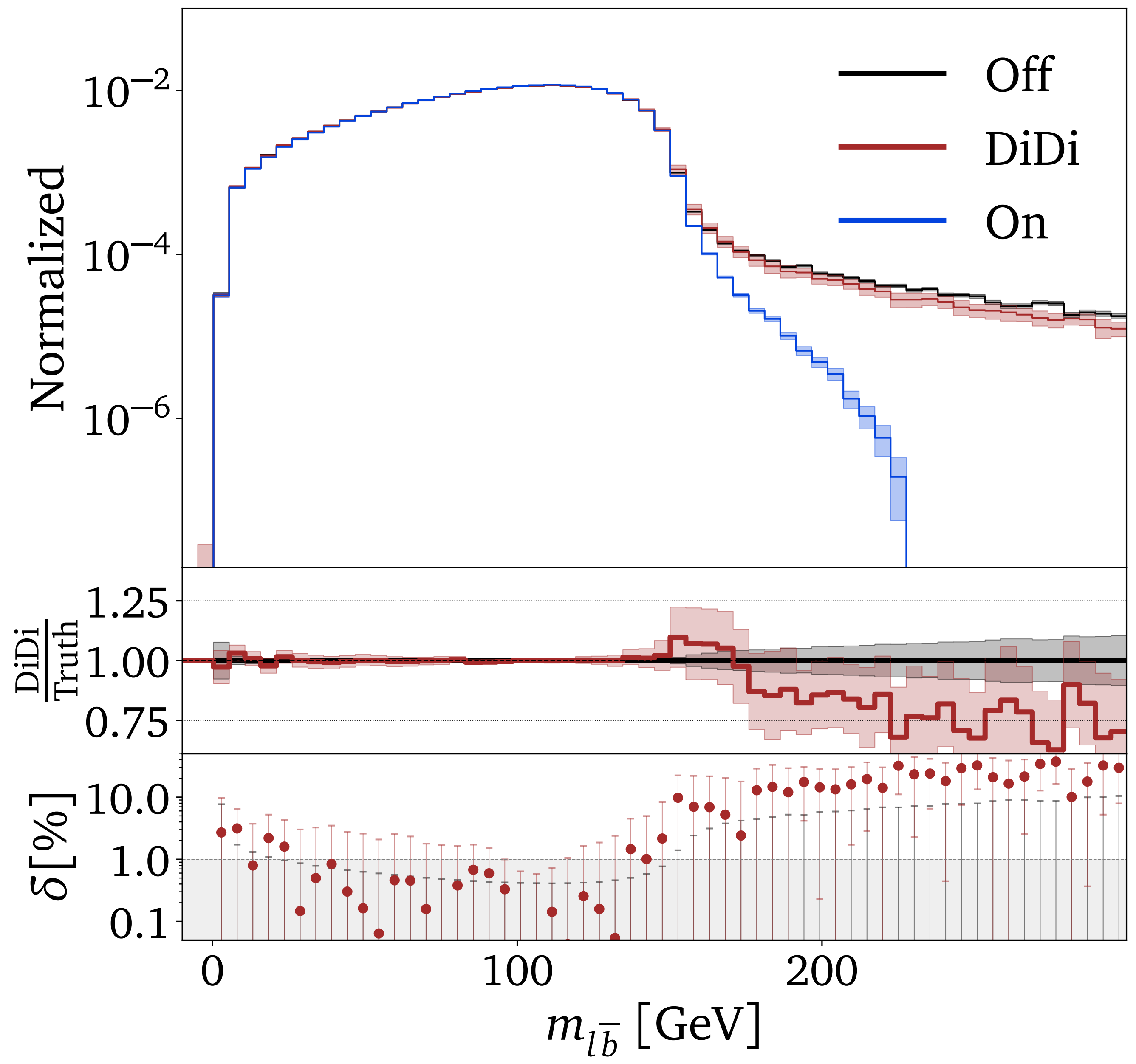


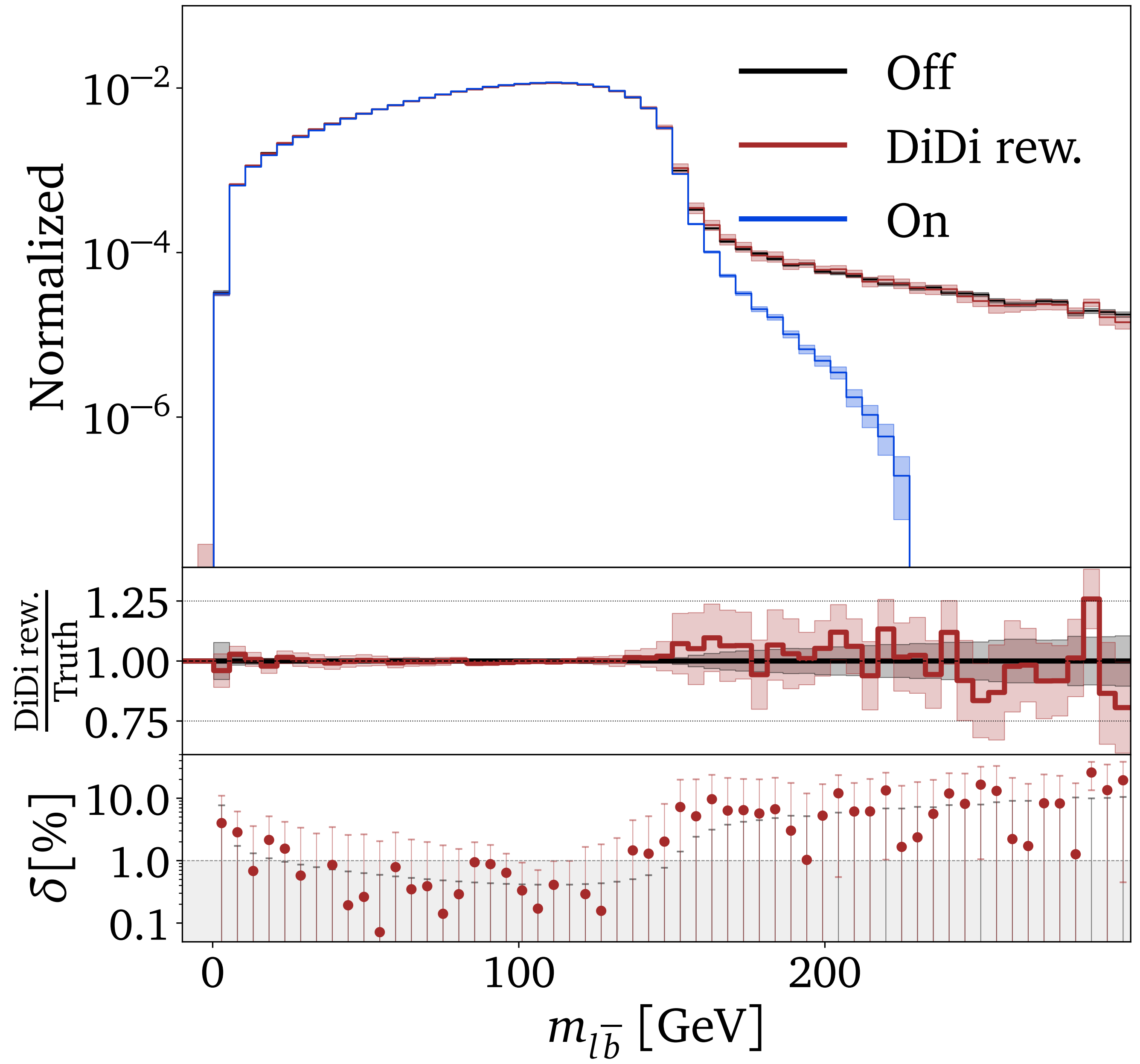
Need: Fast event generator

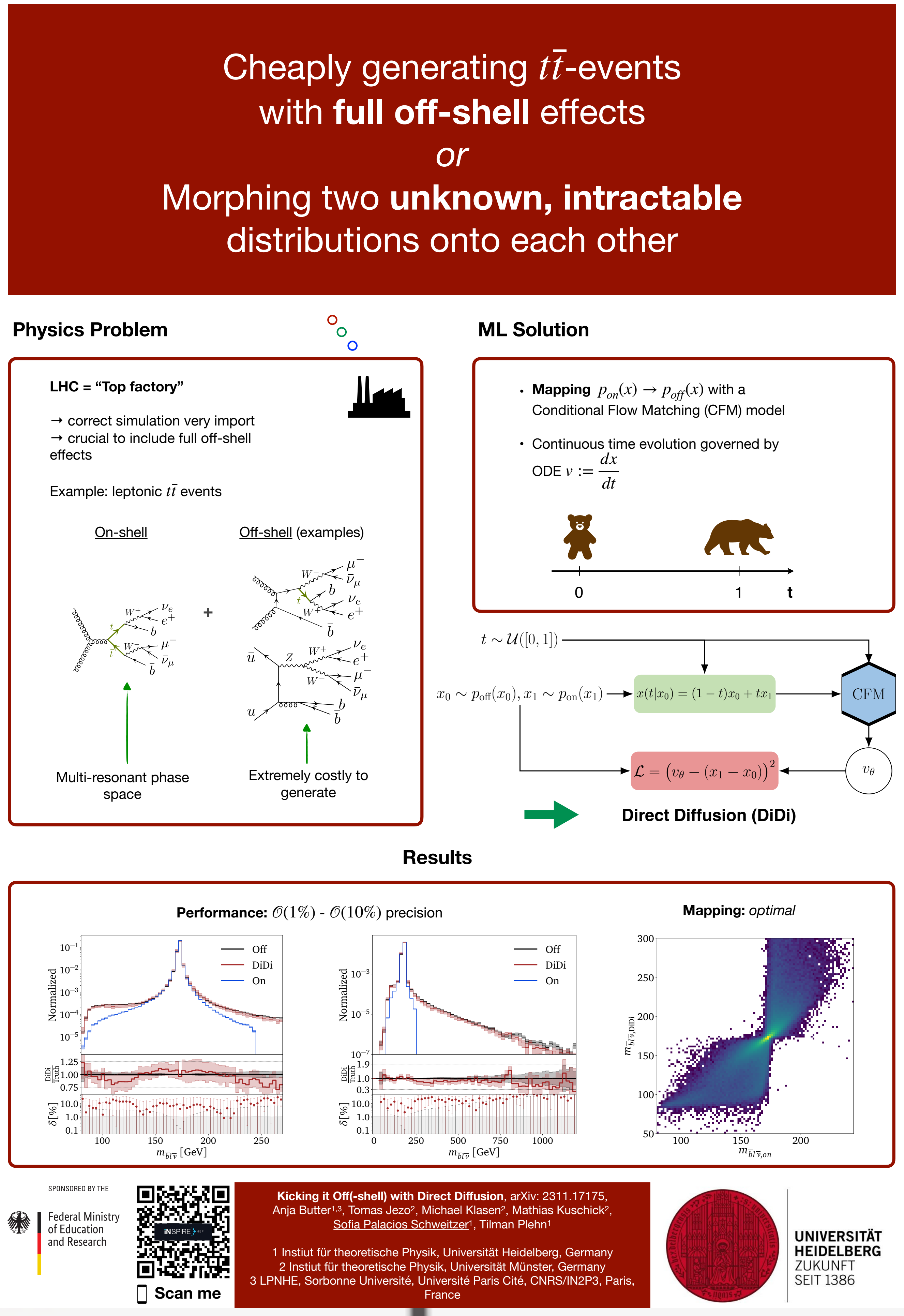
Problem: Multiresonant phase space in 24 dimensions

Direct Diffusion (DiDi)









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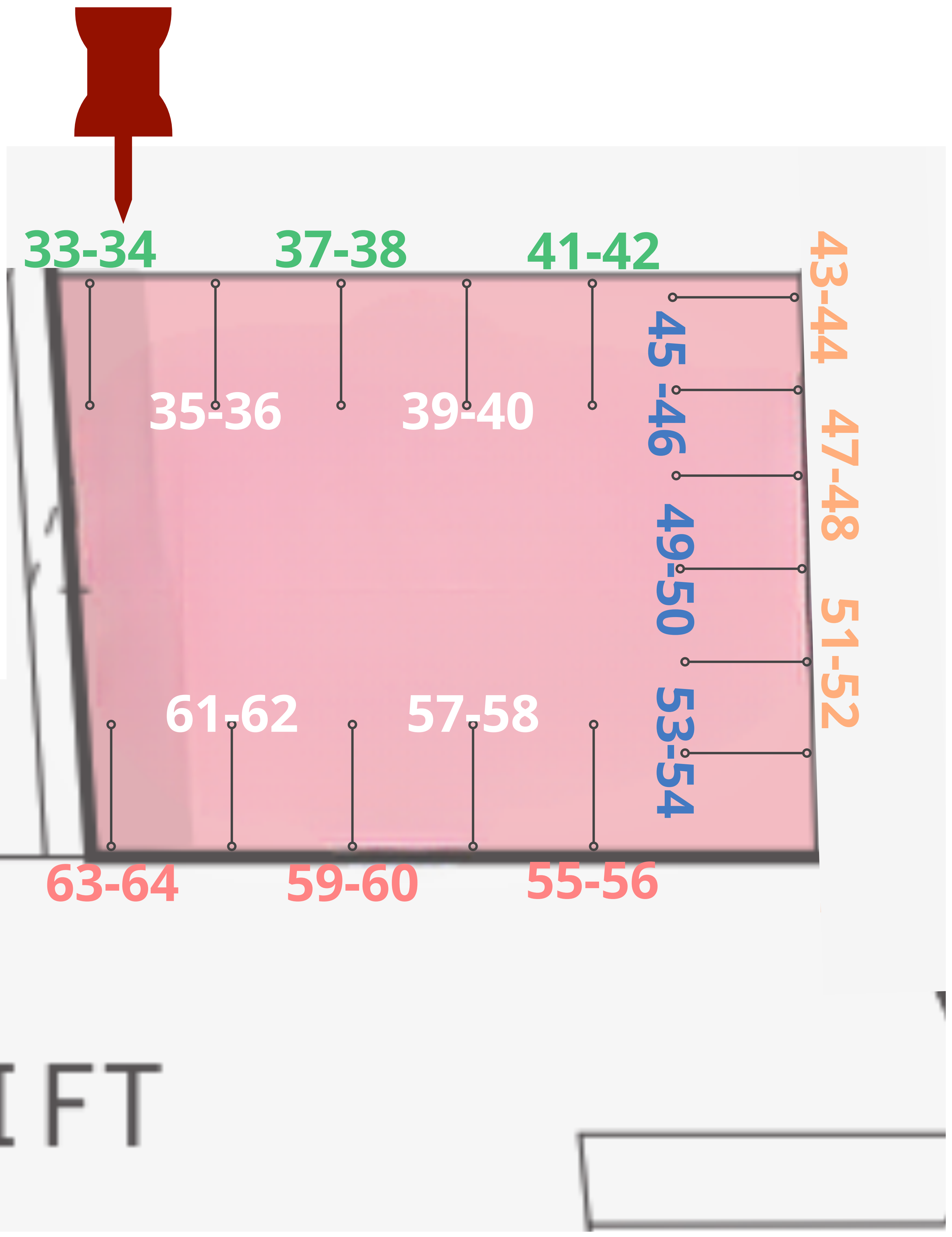
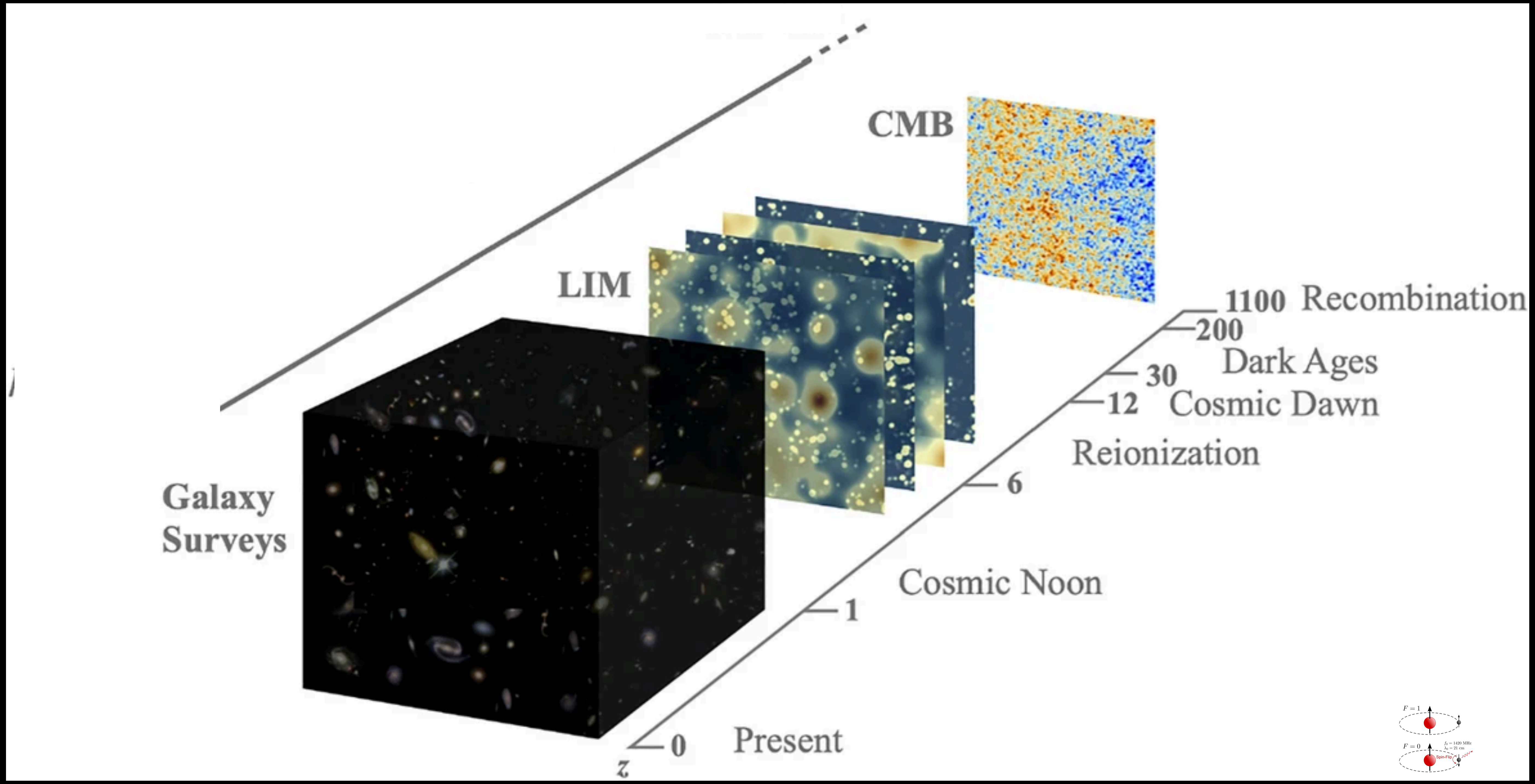
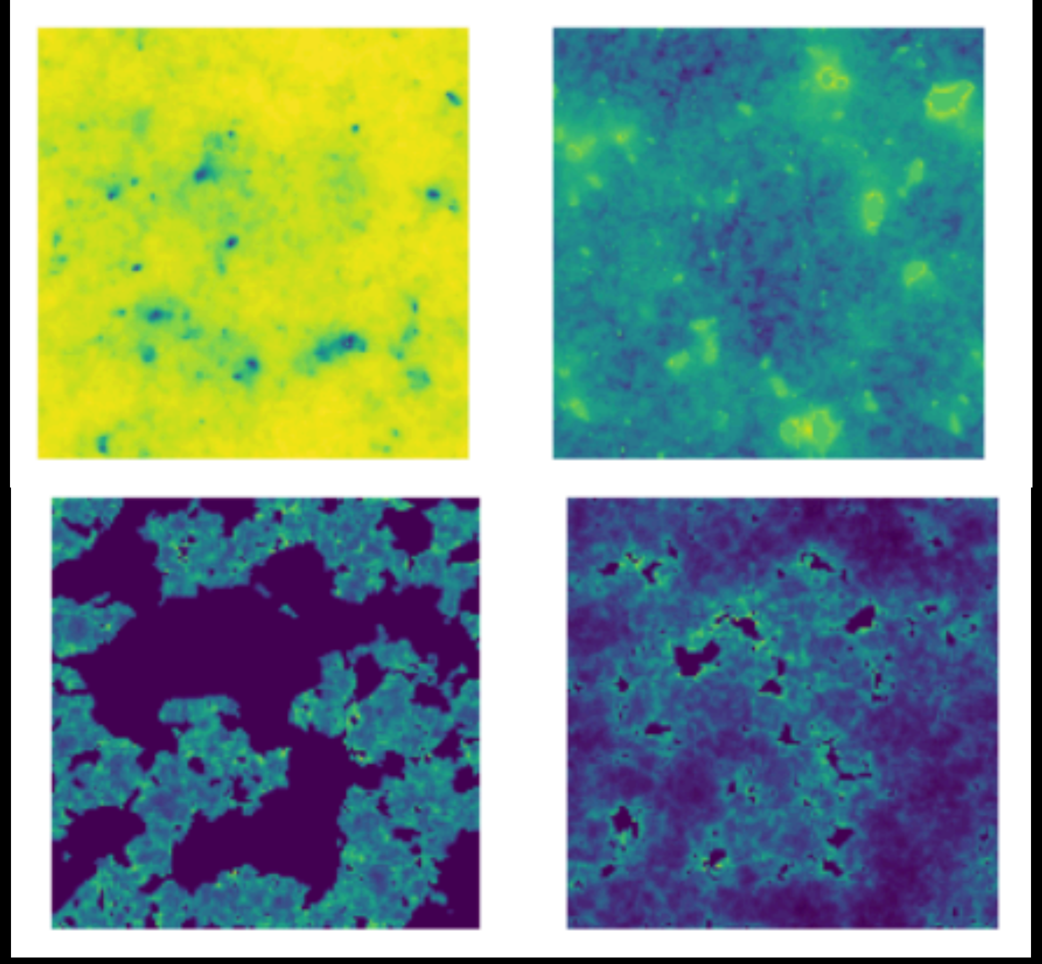


LARA ALEGRE EXPLORING THE UNIVERSE WITH RADIO ASTRONOMY AND AI

Group led by Dr. Caroline Heneka





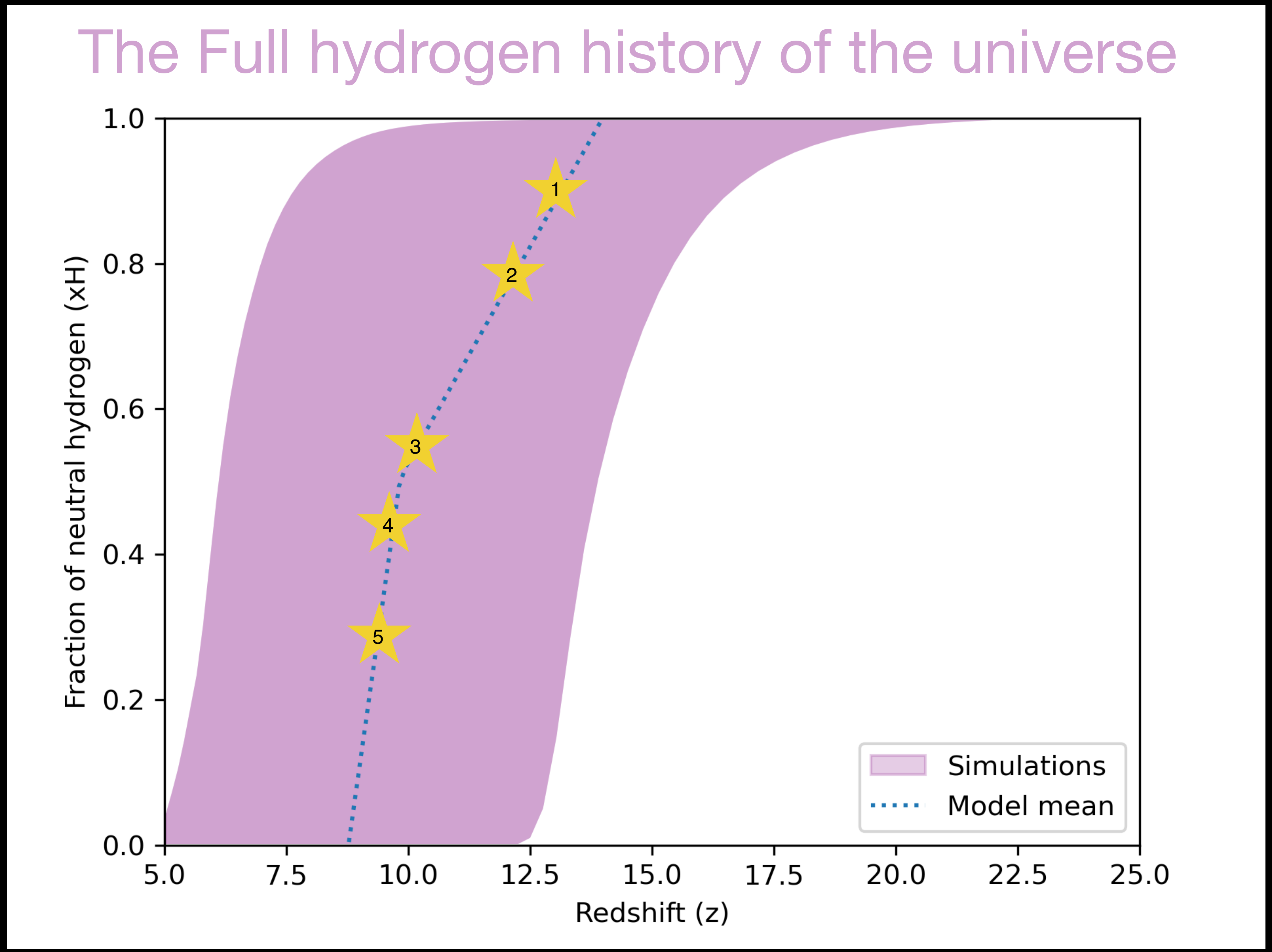
LARA ALEGRE EXPLORING THE UNIVERSE WITH RADIO ASTRONOMY AND AI

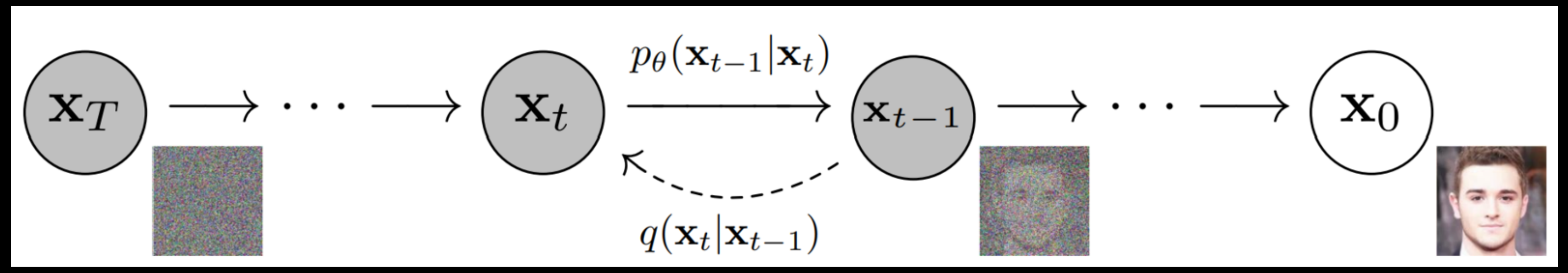
UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

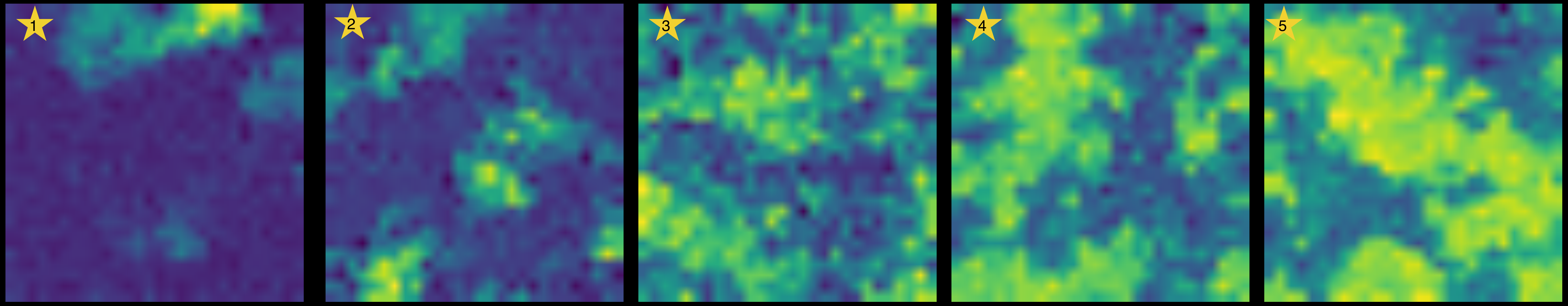
VolkswagenStiftung

FREIGEIST FELLOWSHIP DER VOLKSWAGENSTIFTUNG

Group led by Dr. Caroline Heneka







10% 20% 45% 55% 65%