# The PAU survey: Photometric redshifts with deep learning

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## The PAU survey

- The PAU Survey (PAUS) is an innovative photometric survey with 40  100Å wide optical narrow bands at the 4.2m William Herschel Telescope (WHT).

- Achieves σ68 / (1 + z) = **0.0037** to i AB < 22.5 for the redshift range 0 < z < 1.2 selecting the 50% best galaxies based on a photo-z cut.

- Provides a dense galaxy sample with  high precision redshifts to larger depth over a larger area  (now 34 sq. deg.),

## DeepZ code

Our template fitting required an increasing complex galaxy SED modeling and fitting procedure. We use new deep learning code, which includes

- **Transfer learning:** Our networks are pretrained on galaxy simulations.

- **Label smoothing:** Introducing an uncertainty in the spectroscopic redshifts (labels) improves the precision.

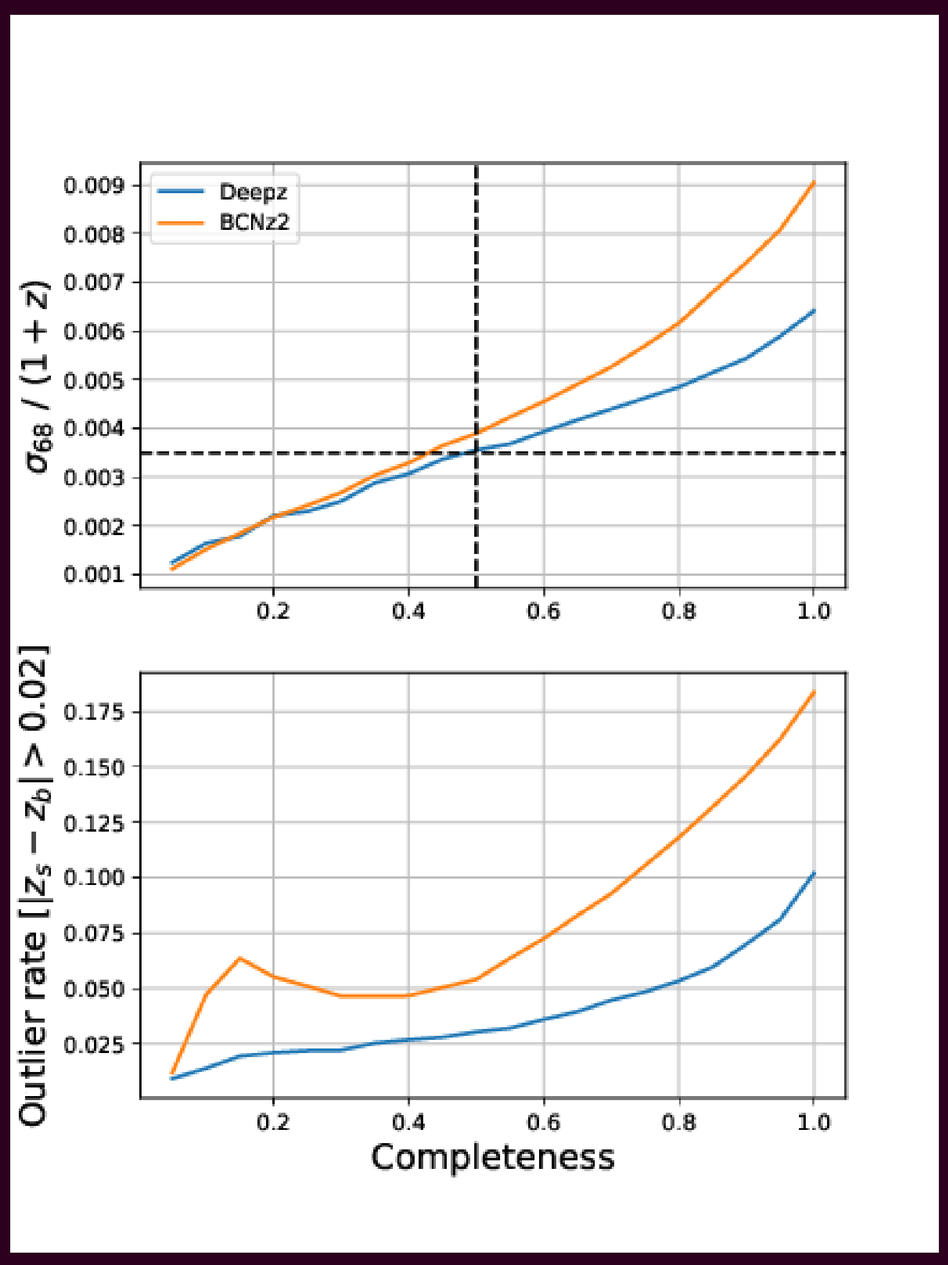
- **Autoencoder:** Encode the information about the galaxy type.

- **Individual exposures**: Train with individual exposure information, not only  the coadded fluxes.

Together with other techniques, which will be detailed in Eriksen et.al. (in prep.).

## Photo-z performance

Below we compare the **photo-z scatte**r (top) and **outlier rate** (bottom) to i<22.5 between the deep learning (Deepz) and temple fitting (BCNz2) codes




## Conclusions

Deep learning increases the precision and reduces the outlier rate for fainter galaxies. This will unique insights into galaxy formation, evolution, clustering and their intrinsic alignments with PAUS.

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