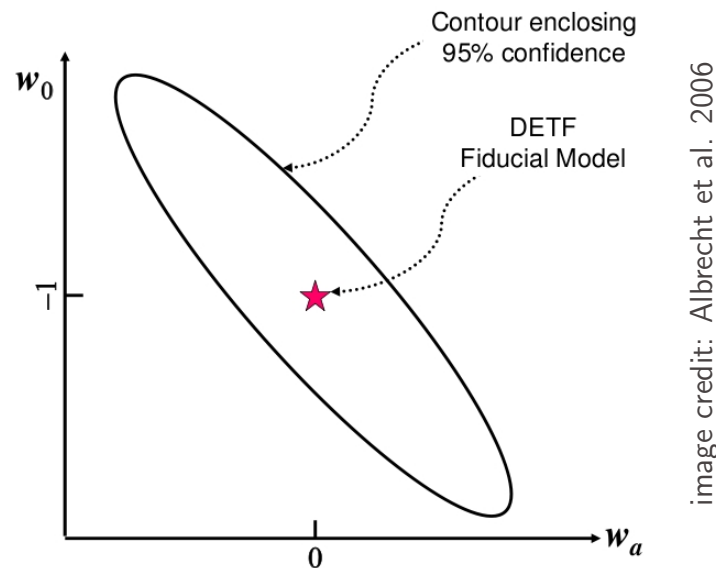


# Future dark energy probes and their robustness to systematics



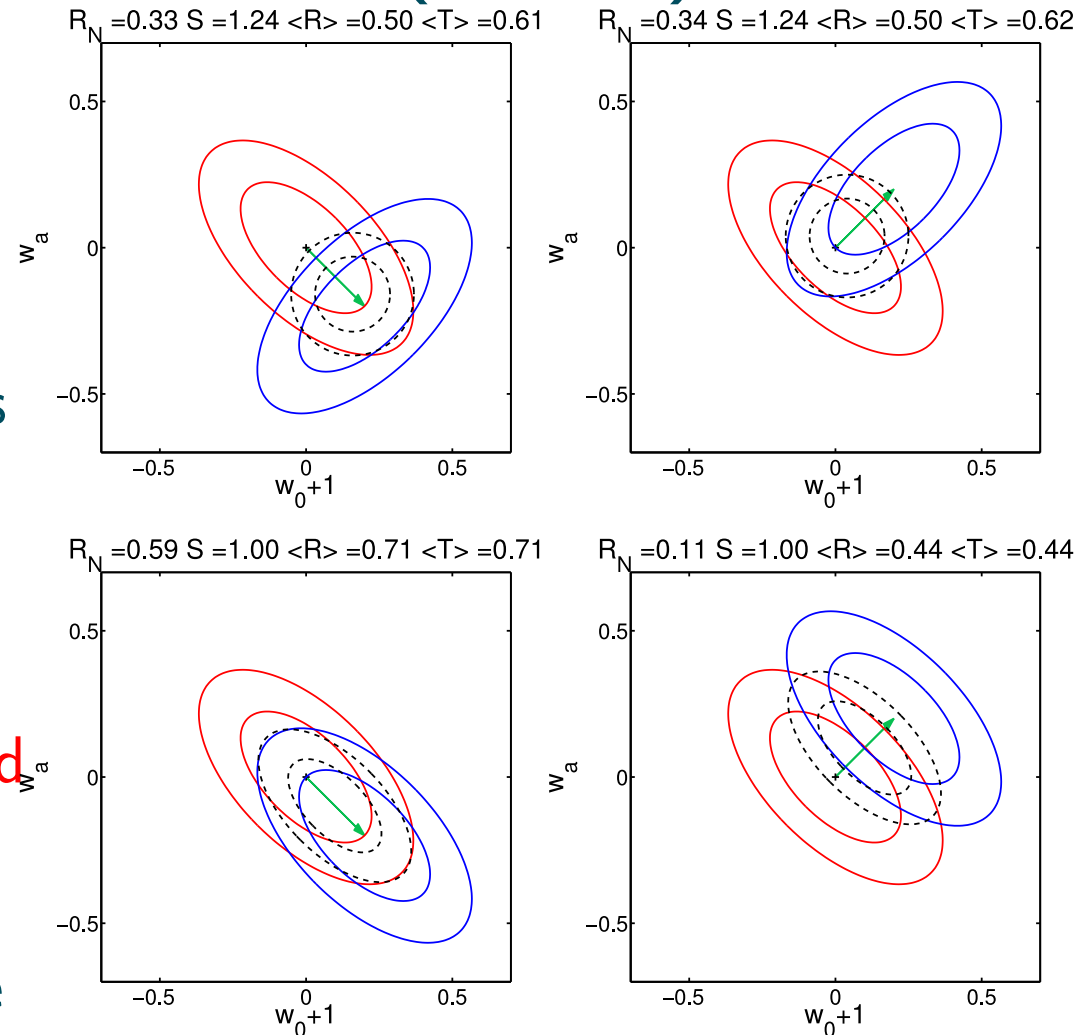
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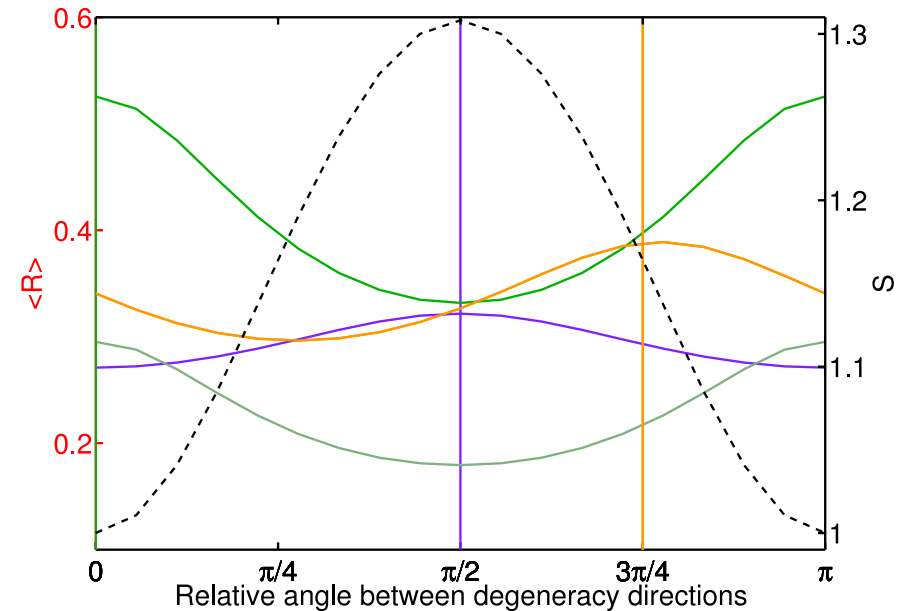
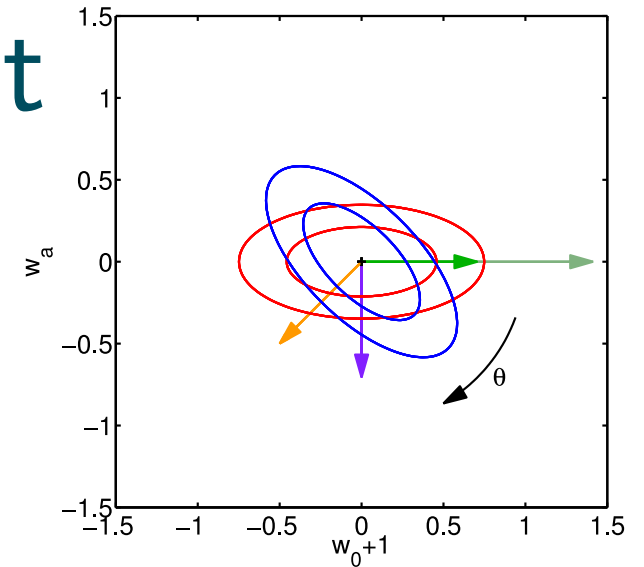
# Statistical Figure of Merit (FoM)

- A FoM gives a prediction of how good the constraints on the parameters of interest will be from a future probe.
- The **statistical** FoM is based on the inverse area of the joint error ellipses (black dashed) from existing (red) and new (blue) probes.
- The **statistical** FoM depends only on the **orientation** of the existing and future probes, but it **does not depend on their degree of overlap**.
- Green arrow indicates possible direction of systematic bias of future probe.



# Robustness Figure of Merit

- The **Robustness** FoM,  $R$  is a Bayesian way to quantify the degree of consistency between the two probes.
- Probes with a **greater degree of overlap** are more consistent, i.e. more **robust to systematic bias**.
- The **average Robustness** FoM,  $\langle R \rangle$  is the Robustness averaged along the length of the bias vector.
- Upper plot shows existing probe (red) and future probe (blue) and a choice of three different bias vectors.
- Lower plot shows variation of Statistical FoM ( $S$ ) and  $\langle R \rangle$  as a function of the rotation angle between the two probes.



# Test application of future probes

- Plots show construction of Robustness FoM for two types of dark energy probe, supernovae Ia (SN, upper plot) and Baryon Acoustic Oscillations (BAO, lower plot).
- Green arrows show a particular choice of possible systematic bias direction and size.
- For this particular choice of bias, SN are slightly more robust than BAO. This is mainly due to alignment of bias and degeneracy directions.

## SUMMARY

- Statistical FoM quantifies orientation of probes.
- Robustness FoM gives measure of degree of compatibility (overlap) of probes, i.e. robustness to systematic errors.

