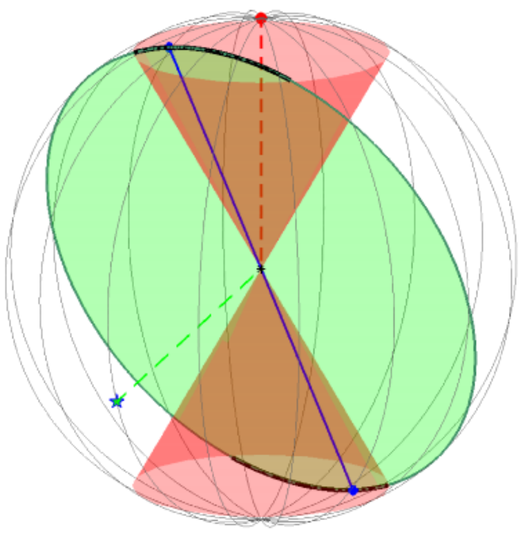
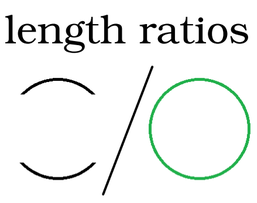
A new analysis of the optical polarisation alignments of quasars

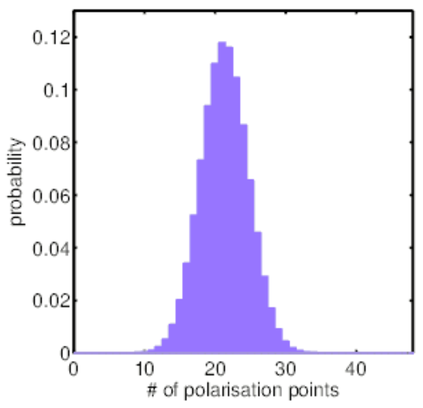
V. Pelgrims (in coll. with J.R. Cudell)
IFPA, AGO Dept., University of Liège

A new coordinate-invariant statistical test for sparse data



length ratios



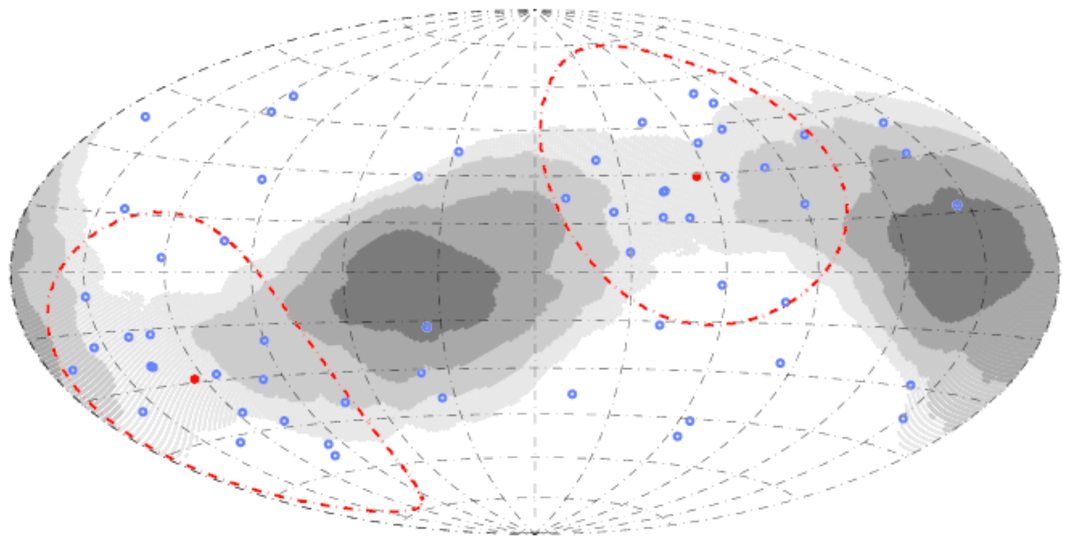


At each location in the polarisation space, a coordinate-invariant probability distribution is semi-analytically computed.

- polarisation in 3-d
- cone algorithm: predicts what a uniform distribution for the polarisation angles would give
- compare with data

The Local Significance Level

The hypothesis of uniformly distributed polarisation angles is tested at each point a by evaluating the probability of the data density.
The alignment direction is defined as the direction a_{min} for which the *local significance level* is the least, i.e. p_{min}.
The direction a_{min} of the most unexpected density (corresponding to p_{min}) is identified as being the alignment direction.



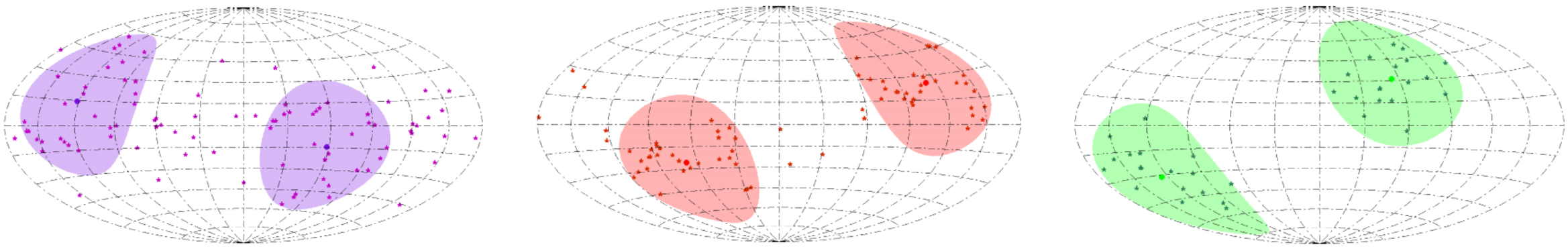
The Global Significance Level

A Monte Carlo treatment leads to the evaluation of the *global significance level* p^σ of an observed alignment to occur anywhere on the sphere.

Application to real data

Confirmation of the large-scale alignments of optical polarisation of quasars (e.g. Hutsemékers et al. 2005)

Determination of three independent regions of alignment through a blind analysis.



$p^\sigma = 1.8\,10^{-4}$ $\quad$ $p^\sigma = 5.0\,10^{-5}$ $\quad$ $p^\sigma = 1.0\,10^{-5}$

NEW

A North-South correlation of polarisation orientations for quasars having $1.3 \leq z \leq 2.0$ and their degree of linear polarisation below 1.5 %
Global significance level of this alignment: $p^\sigma = 2.7\,10^{-5}$

Further details in : V. Pelgrims and J.R. Cudell on arxiv: [1402.4313] (submitted to MNRAS)

V. Pelgrims, IFPA - AGO Department - Liege University - Liege, Belgium Mail: pelgrims@astro.ulg.ac.be