

MATHEMATISCHES FORSCHUNGSINSTITUT OBERWOLFACH

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## **New Horizons in Statistical Decision Theory**

Organised by  
Richard Gill, Leiden  
Madalin Guta, Nottingham  
Michael Nussbaum, Ithaca

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**ABSTRACT.** The classical metric theory of statistical models (experiments) has recently been extended towards an asymptotic equivalence paradigm, allowing to classify and relate problems which are essentially infinite dimensional and ill-posed. Modern statistical concepts like these are also being integrated into the emerging field of quantum statistics, which is developing on the background of technological breakthroughs in quantum engineering. The workshop brought together leading experts in these areas, with the goal of establishing a common language, and fostering collaborations between mathematical statisticians, theoretical physicists and experimentalists.

*Mathematics Subject Classification (2010):* 62G20, 81P45.

### **Introduction by the Organisers**

The workshop *New Horizons in Statistical Decision Theory* was the first significant meeting bringing together researchers from mathematical statistics and quantum information theory, under the broad umbrella of statistical decision theory. The aim of the workshop was twofold. The first goal was to review recent progress in these areas, e.g. in non-parametric regression, confidence intervals, quantum local asymptotic normality and quantum compressed sensing tomography. The second, and perhaps more important goal, was to establish a communication platform and facilitate the exchange of methodology and techniques between the two fields.

Recent progress in quantum information technologies has brought the statistical analysis of quantum measurements data to the forefront of experimental and theoretical efforts. The increasing complexity of quantum devices requires a new

range of statistical methods to deal with large dimensional models, model selection, measurement design, and reliable confidence intervals. In the same time, many key statistical concepts from statistical decision theory have been extended to quantum statistics, bringing the two subjects closer together, and making the workshop a very timely event.

In recognition of his pioneering work at the interface of quantum theory, information theory and statistics, the workshop was opened with a presentation by Alexander Holevo on the recently solved quantum Gaussian optimizers conjecture. The program contained a mixture of alternating statistics and quantum information presentations. To increase the accessibility, the speakers observed the “15 minutes rule” of beginning with a broad overview of the subject. Additionally, a lively dictionary session was organised on Tuesday, and several open problems were debated in another session on Thursday. PhD students had the opportunity to present their results with short presentations in a special evening session.

As organisers we were gratified by the level of engagement of participants on both sides, lively discussions and emerging collaborations. The excellent atmosphere was facilitated by the working environment at the MFO to which we would like to express our deep gratitude.

*Richard Gill, Madalin Guta and Michael Nussbaum*

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