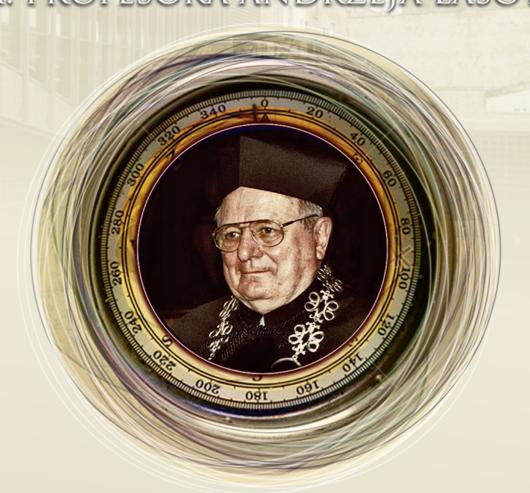


## REKTOR Uniwersytetu Śląskiego w katowicach

SERDECZNIE ZAPRASZA NA

IM. PROFESORA ANDRZEJA LASOTY



PROFESSOR PIERANGELO MARCATI Gran Sasso Science Institute L'Aquila - Italy title:

## MATHEMATICAL CHALLENGES IN THE THEORY OF QUANTUM FLUIDS

IN THIS LECTURE WE WILL DISCUSS A RESEARCH FIELD THAT BRINGS TOGETHER PROBLEMS WITH STRONG MOTIVATION IN QUANTUM PHYSICS AND MATHEMATICAL TECHNIQUES BORN IN THE FIELD OF HARMONIC ANALYSIS AND USED FOR THE ANALYSIS OF DISPERSING PHENOMENA. IN PARTICULAR, THE DESCRIPTIONS THAT USE EFFECTIVE EQUATIONS OF THE NON-LINEAR SCHRÖDINGER TYPE (GROSS-PITAEVSKII) HAVE A FORMULATION OF A FLUID-DYNAMIC NATURE. WE WILL DEMONSTRATE A MATHEMATICALLY RIGOROUS THEORY THAT JUSTIFIES THESE CONNECTIONS AND POSES NEW MATHEMATICAL CHALLENGES. IN CONCLUSION, WE WILL MENTION HOW SOME IDEAS OF DYNAMICS ON FRACTALS, WHICH WERE ONE OF ANDREZEJ LASOTA'S TOPICS OF INTEREST, CAN FIND APPLICATION IN THE STUDY OF QUANTUM TURBULENCE.

## Streszczenia /Summary

## Pierangelo Marcati

"Mathematical challenges in the theory of quantum fluids"

In this lecture we will discuss a research field that brings together problems with strong motivation in quantum physics and mathematical techniques born in the field of harmonic analysis and used for the analysis of dispersing phenomena. In particular, the descriptions that use effective equations of the non-linear Schrödinger type (Gross-Pitaevskii) have a formulation of a fluid-dynamic nature. We will demonstrate a mathematically rigorous theory that justifies these connections and poses new mathematical challenges. In conclusion, we will mention how some ideas of dynamics on fractals, which were one of Andrzej Lasota's topics of interest, can find application in the study of quantum turbulence.