Prof. Paolo Calvani
Dipartimento di Fisica
Università di Roma La Sapienza
Piazzale A. Moro, 2
00185 Roma, Italia

To Prof. Dr. Josef Humlicek
Insititute of Condensed Matter
Faculty of Science, Masaryk University Kotlarska 2
CZ-671137 BRNO
Czech Republic

Report on the thesis of Dr. Dubroka

The Habilitation thesis of Dr. Dubroka reports on a large number of scientific results collected by the candidate in the last years, especially by advanced infrared spectroscopy, on the novel superconductors and on the interfaces between insulating thin films. Both subjects are situated at the frontier of the present research in solid state physics and in materials science.
The results are reported in a long series of publications on leading physics journals. They are preceded by an Introduction, very well and clearly written, on the technique of infrared ellipsometry and on its applications to the scientific problems addressed in the thesis. I have particularly appreciated the treatment of the Berreman effect – and its interpretation in terms of a simple electromagnetic model – as well as that of the Transverse Plasma Resonance in layered compounds.

Indeed, the unifying subject of the thesis, throughout different materials and techniques (given that also muon relaxation results are reported therein) is the electrodynamics of inhomogeneous materials with focus on the interlayer effects. These can be produced artificially, like in the LaAlO3/SrTiO3 heterostructures, or they can appear spontaneously in anisotropic systems like the crystals of cuprates and of iron-based pnictides.
Among the numerous valuable results reported in the thesis, three recent experiments should be mentioned. They make use of three different techniques of infrared spectroscopy, namely, ellipsometry, normal-incidence reflectance, and time-resolved spectroscopy, thus showing the capability of the candidate to obtain good results with different experimental tools.

The first one is the very nice work on the LaAlO3/SrTiO3 interfaces. At the boundary between these two insulators, as well in other heterostructures like LaMnO3/SrMnO3, a conductive sheet develops spontaneously, due to an electronic reconstruction across the heteropolar interface. Dr Dubroka and his coworkers have been able, by using ellipsometric techniques, to fully characterize the metallic sheet in terms of number of carriers, effective mass, and polaronic effects.