

Supervisor evaluation of Ph.D. thesis of Tomáš Markovič
Effect of magnetic field perturbations on tokamak plasma

Tomáš Markovič elaborated his Ph.D. thesis at Institute of Plasma Physics of the CAS at Tokamak department. The central topic of his research work was the study of various aspects of interaction of magnetic field with tokamak plasmas. Additionally, his scientific activities comprised also topics associated with development, commissioning and performance evaluation of magnetic diagnostics for tokamaks, measurement and modelling of effects of ferromagnetic components on distribution of magnetic field, development of algorithms for evaluation of plasma position and shape, and advanced MHD studies namely in the area of Alfvénic modes. COMPASS tokamak was a pivotal device for the major part of these activities although, he exploited also smaller devices GOLEM (CR) and STOR-M (Canada) and some of his results have direct implications for presently built fusion reactor ITER (France).

Ph.D. thesis of Tomáš Markovič contain only a certain part of the work he conducted along his rather extended period of PhD study and it is the part associated with interaction of 3D magnetic field with COMPASS tokamak plasmas. This part of his work can be considered as the most valuable from the point of view of fundamental high temperature magnetized plasma physics. The principal conclusion of the thesis is that plasma response to the externally applied magnetic field in tokamaks is essential for understanding and proper description of the observed phenomena. Previously used so called vacuum field approximation is not applicable in the most of the cases. This finding is demonstrated within two research areas. Firstly, the linear ideal MHD simulations of how plasma screens the magnetic perturbation fields in core plasma were conducted and their results compared to the experimental observations. These results contributed to the development of the empirical perturbation magnitude threshold scaling relation for tokamak ITER. Secondly, the joint experimental and ideal MHD plasma screening modelling approach was applied to study ELM experiments on COMPASS, to show the importance of the plasma screening effect in edge plasma.

From the formal point of view, the thesis is written in English with appropriate extent of 144 pages. Quality and clarity of the text is satisfactory with no apparent misprints or confusing formulations. Also graphs and figures are of a very good quality without any readability issues. The total number of references is 145 and they are properly used within the text.

Tomáš Markovič managed to demonstrate during his PhD study a rather unique ability to combine experimental and modelling approach, both at exceptionally high level, to tackle advanced high temperature plasma physics problems. He conducted his research in large extent independently and early on, the style of his scientific work corresponded rather to postdoc than PhD level. He demonstrated his ability to work in a larger scientific team particularly during his experimental activities on COMPASS where international collaboration with many colleagues with different expertise and backgrounds is inevitable. Later on, he gradually integrated also in European fusion research projects in the area of resonant magnetic perturbation studies and he was formally adopted as EU expert within ITPA Topical Group on MHD, Disruptions & Control. He participated on re-commissioning of COMPASS magnetic diagnostics after relocation of COMPASS to IPP Prague from Culham, UK. Later on, he took responsibility for design and preparation of the new magnetic diagnostic system for COMPASS-U featuring many unique parameters and challenges like compatibility with 500 °C, among others. The magnetic diagnostic of COMPASS-U passed the conceptual design review phase, and it is well advanced toward defence in front of the international final design review panel. Tomáš Markovič became author or co-author of 25 papers in international peer reviewed journals and 15 conference proceedings papers during the period of his PhD studies.

According to my opinion, Tomáš Markovič exceptionally clearly demonstrated his ability to successfully conduct all aspects of independent research work at internationally competitive level. I recommend his thesis to be accepted after successful defence for the doctoral degree.



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