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PhD thesis report:
Vadym Khomenko, Superfluid neutron star dynamics

The candidate has provided an interesting PhD thesis describing progress on a number of issues relevant for observed pulsar glitches, relying on the modelling of superfluid components in the star's high-density interior. The thesis is based on four published papers, summarized in a detailed introduction. The material is of the standard I would expect from a PhD thesis, and there are certainly a sufficient number of new ideas and results to warrant the award of the degree. In terms of presentation, I feel I only need to comment on the introduction as the four papers have already passed through peer review and (most of the) typographical issues and minor mistakes have been resolved in the process. The introduction is clear and fairly well written. It provides a useful summary of the results in the papers, demonstrating that the candidate is well on top of the material. I could point to some minor grammatical issues but will not do so as they do not cause confusion. The presentation is of a good enough standard and the key point is (in my opinion) that the discussion demonstrates a clear understanding of the material in the thesis.

The four published papers cover a range of issues relevant to the pulsar glitch problem, adding to other recent work in the literature. There are novel aspects to each paper and combined they make for an interesting read. While they do not solve the problem, they clearly contribute to our understanding – especially of the link between theory and observations. The first paper contributes a novel discussion of vortex fronts, an idea I found particularly appealing. The second paper develops a relatively simple toy model for glitches, the results of which shed light on the some of the dynamical issues of the problem. The third paper – an real tour de force – works out the local wave behaviour in the dissipative two-fluid model at a level of detail I am not sure I would be willing to take on myself. The results extend previous efforts and provide new insights into the role of turbulence for wave instabilities; a very interesting problem. Finally, the fourth paper considers different phenomenological nonlinear forms for the all-important vortex mutual friction. The results suggest a possible explanation for the bimodal distribution of observed glitch events. I am not wholly convinced that this is the final answer, but there is no doubt that the work presented here provides a useful step in the right direction. Overall, the work presented in the thesis is of a high academic standard and should be sufficient for the award of the degree.

Summing up, I consider the doctoral thesis of Vadym Khomenko to be a valuable contribution that meets the criteria prescribed by the law for a doctoral

dissertation. Therefore, I request that this dissertation be admitted to a public defense.

Prof N. Andersson