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REJOINDER TO NOTE ON THERMAL INSTABILITY OF A HORIZONTAL LAYER OF NON-NEWTONIAN FLUID HEATED FROM BELOW

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REJECTION of the power-law model on the grounds that it does not reduce to Newtonian behavior at vanishingly small shear presumes *that non-Newtonian fluids are universally characterized by a zero-shear viscosity in the limit.* While this may be both desirable and appealing, as it seems to be to Mr. Wankat, the inescapable fact remains that the flattening of the rheogram, characteristic of the approach to Newtonian behavior, is not observed experimentally with many non-Newtonian fluids. The viscometric data on the fluids used in our experiments indicated power-law behavior, and thus our choice of model is based on observed fact rather than on any presumed rheological behavior.

While we were not aware of the paper by Joseph [4] referred to by Wankat, we cited and used the work of Chandrasakhar which, of course, predates all the references relating to the theory, and indeed contains all the essential elements of the theories concerned, and, in particular, forms the basis for the extension to power-law behavior used in our paper. In addition, Chandrasakhar's principal becomes exact for Newtonian fluid.

Finally, the use of Newtonian solutions for the temperature and velocity fields in our approximate method can be defended, if indeed this is necessary, on the grounds that the power-law model does reduce to Newtonian behavior, namely, when the index $n = 1$. We do not pretend to offer the power-law model as a realistic constitutive equation; it is used in our paper merely as a convenient empiricism which happens to describe our rheological data. Wankat's clear implication, however, that models such as those of Oldroyd represent more realistic constitutive equations is at odds with the fact that many of these models, and Oldroyd's model is a particularly good example here, fail to give a quantitative description of observed fact.

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