Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

On the Role of Electronic Polarization in Continuous Structural[1]

PETER RISEBOROUGH, Temple University — Martensitic transitions are defined to be diffusionless structural transitions that lower the crystal symmetry and in which the order parameter, usually strain and shuffle, changes discontinuously. It had been proposed that martensitic transitions are driven by the entropy, due to the soft phonons. Anderson and Blount have shown that it is highly improbable that structural transitions are second-order (continuous) and they have suggested that the apparently continuous structural transition in V_3Si is a ferroelectric transition. Recently, a continuous structural martensitic transition has also been identified in AuCd strain glass by Wang *et al.* and in single crystal AuZn by Lashley *et al.*. Furthermore, pressure measurements on AuZn show that the martensitic temperature can be depressed and indicate the existence of a quantum critical point [5]. The exact nature of apparently continuous structural transition is still being debated. However, measurements of magneto-acoustic oscillations in the speed of sound of AuZn, indicate that the phonon softening may be driven by the polarization of the conduction electrons. This has been confirmed by recent measurements on AuZn and V_3Si in magnetic fields which have shown that the transitions are intimately linked to the dielectric response, and are in accord with the predictions of Dieterich and Fulde for V_3Si. Various theoretical scenarios concerning continuous structural transitions are discussed.

[1]This work was supported by the U.S. Department of Energy, Office of Basic Energy Sciences through award DEFG02-01ER45872.

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Date submitted: 16 Nov 2009 Electronic form version 1.4