The dynamics associated with soft mode behaviour for a particular crystal undergoing a ferro-rotative phase transition is considered in neutron diffraction patterns are introduced. The data obtained are successfully modelled using a rigid-ion description of the crystal.

Specific examples of anti-fluorite crystals with room temperature static structures belonging to space group Fm3m, distort to form structures of lower symmetry as the temperature is reduced. The order parameter for each transition is describable by a particular normal mode of the crystal; the order parameter is a single irreducible representation of the high symmetry group. Group theoretical methods are used to develop a classification scheme for these phase transitions.

The soft mode behaviour for a particular crystal undergoing a ferro-rotative phase transition is considered in detail. The data obtained are successfully modelled using a rigid-ion description of the crystal.

Phase transitions giving rise to incommensurately modulated structures have recently been found in numerous ferroelectric and related crystals. General survey is given of the recent results obtained by the author and others, especially in Japan, on these crystals. Various kinds of temperature change of the order parameter is a single irreducible representation associated with the phase fluctuations of the modulation. In a few materials this mode has been observed but in many other materials it has proved to very elusive.

In many materials the wavenumber of the modulated phase changes with temperature, and lock-in to a commensurate wavenumber at low temperature. The lock-in transition can be described as an instability of the low temperature phase against domain walls in the phase modulations. Theoretically the modulation pattern for these domain walls should consist of many Fourier components but experimentally these are not usually observed. Possible reasons for this and other discrepancies between theory and experiment at these transitions will be described.

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Methods are used to develop a classification scheme for these phase transitions. The specific examples of low symmetry static structures deduced from nuclear quadrupole resonance spectra and neutron diffraction patterns are introduced. The soft mode behaviour for a particular crystal undergoing a ferro-rotative phase transition is considered in detail. The data obtained are successfully modelled using a rigid-ion description of the crystal.

High resolution X-ray studies of Zn-TaSe_2: Observation of the striped CDW phase. By D. E. Moncton and E. M. Fleming, Bell Laboratories, Murray Hill, NJ 07974.

Previous neutron scattering experiments (Moncton et al., Phys. Rev. Lett (1975) 34, 734) established the formation of an incommensurate charge-density wave (CDW) state in Zn-TaSe_2 at 122 K and the lock-in to a commensurate structure near 90 K. These CDW states were shown to consist of the superposition of displacement waves in three equivalent (100) directions. Motivated by the observation of a third phase transformation at 112 K in dilatometry studies (Steinitts et al. Solid State Commun. (1979) 25, 519), high resolution X-ray studies were undertaken. These experiments (Fleming et al. Phys. Rev. Lett (1980) 45, 576) reveal the formation of a striped CDW phase in which one of the three CDWs is commensurate while the other two are incommensurate. We will discuss the detailed behavior of Zn-TaSe_2 as a function of temperature and pressure with emphasis on the nature of this new CDW state.