05.1—45   PHASE TRANSITION FROM A PARAMAGNETIC
TO A MAGNETICALLY ORDERED CRYSTAL.
By T. Maczyński and J. Kociński, Institute of
Physics, Warsaw Technical University,
00-662 Warszawa, Koszykowa 75, Poland.

On the basis of Landau's theory we have calcu-
lated changes of symmetry at a continuous
phase transition of a paramagnetic crystal of
symmetry $P6_3/mmc1'$ to magnetically ordered
phases. The symmetry changes are induced by
active representations connected with the wave
vector $\vec{k} = \gamma\vec{b_3}$, /-0.5< γ < 0.5/. These repre-
sentations fulfil the reality condition, the
Kovalev condition and the weak Lifshitz con-
dition. We have considered two active repre-
sentations which correspond to spins perpen-
dicular to the C_6 axis. It has been proved
that there can appear two types of spin struc-
tures: /1/ with constant spin length, i.e.
helical structures, and /2/ with varying spin
length, i.e. sinusoidal structures. For the
first case, formulae for the spiral structures
which are valid for any value of γ from the
interval /-0.5,0.5/ have been given. We can
thus obtain commensurate or incommensurate
helical spin structures. With an appropriate
value of γ we can obtain the helical structure
of dysprosium crystal. In Landau's theory, the
corresponding phase transition can be conti-
nuous. For the second case we give an example
of a sinusoidal spin structure which is cha-
racteristic for neodymium crystal. The type of
magnetic group to be assigned to a particular
spin structure depends on the value of γ.

05.1—47   STRUCTURES OF THE FERROELECTRIC AND
           PARAELECTRIC PHASES OF METHYLAMMONIUM
TRICHLOROMERCURATE. By M.Körfer, H. Fuess and
J.W.Bats,Institut für Kristallographie der Uni-
versität,Frankfurt am Main,Federal Republic of
Germany

A first order ferro/paraelectric phase transi-
tion in $CH_3NH_3HgCl_3$ at 61°C was observed by dif
ferential scanning calorimetry,by birefringence
and DK-measurements. The DSC-peak exhibits con-
siderable structure and extends over about 1°C.
The ferroelectric room temperature structure
has space group $P3_2$,but shows three pseudo two-
fold axes(Ben Salah et al.,Z.anorg.allg. Chem.
(1982) 493,178).Further refinement was achieved
by the introduction of two domains linked by a
two-fold axis (R(F) decreased from 0.056 to
0.046). In the paraelectric phase,the structure
is described in the monoclinic space group C2
(a=13.818(2),b=7.884(1),c=9.734(3),ß=90.49(2)).
The polar three-fold axis is lost and one
pseudo two-fold axis becomes a real one. Two
Hg-atoms become symmetrically independent with
drastically changed Hg-Cl distances as compared
with the ferroelectric phase. Spectroscopic
studies of the dynamics of the phase transition
are in progress. The structures of the chemi-
cally related compounds $CH_3NH_3HgBr_3$(space group
$P2_1/m$;a=7.985(2);b=6.387(8),c=8.728(3), ß =
117.17(3)) and $CH_3NH_3HgJ_3$ (space group $P2_1/n$;
a=9.089(4),b=7.006(4),c=14.817(11),ß=91.70(4))
were also determined, but these compounds are
not ferroelectric at room temperature.

05.1—46   FERROELASTIC PHASES AND ORDER PARAME-
TER   TREATMENT   IN $Pb_3(P_{1-x}As_xO_4)_2$.   By
U.Bismayer, E.Salje[+], A.M.Glazer and J.Cosier,
Clarendon Laboratory, Parks Rd.,Oxford OX1 3PU,
UK.
[+]Institut für Kristallographie und Petrogra-
phie, Universität Hannover, Welfengarten 1,
3000 Hannover 1, Fed. Rep. Germany.

Lead phosphate and the isostructural mixed cry-
stals of lead phosphate—arsenate exhibit fer-
roelastic transitions between the phases R$\bar{3}$ m,
C2/c and $P2_1/c$. High precision measurements of
optical birefringence and dielectric measure-
ments revealed at temperatures below 100K in
all compounds a further transition. In lead
arsenate this probably corresponds to the
transformation of $Pb_3(VO_4)_2$ to the acentric
phase $P2_1$.
In $Pb_3(PO_4)_2$ the critical order parameter ex-
ponent β fits in with a multicomponent order
parameter model with q = 3, d = 2 (Salje and
Devarajan, J. Phys. C (1981) 14, L1029). Along
with the results of infrared reflection spec-
troscopy, diffuse X-ray, neutron and Raman
scattering, the precursor ordering behaviour
indicates dynamical fluctuations in $Pb_3(PO_4)_2$
and a static intermediate phase in the mixed
crystals.
The transition C2/c – $P2_1/c$ is interpreted in
terms of a two-order-parameter theory, which
clearly demonstrates how the first-order tran-
sition in pure $Pb_3(AsO_4)_2$ becomes smoother in
$Pb_3(P_{0.2}As_{0.8}O_4)_2$.

05.1—48   A NEUTRON SCATTERING STUDY OF THE
INCOMMENSURATE PHASE IN ALPO4 (BERLINITE) NEAR
THEα-β TRANSITION.By H. Arnold[+], J. Bethke[+],
G. Eckold[+ ++], Th. Hahn[+], J. Min-Hua[+++]; + Inst.
für Kristallographie, RWTH Aachen, 51 Aachen,
++ Inst. für Festkörperforschung, Kernforschungs-
anlage Jülich, 5170 Jülich, FRG; +++ Crystal
Material Institut,Shandong University,Jinan Shan-
dong, The Peoples Rep. of China.

Quartz and its isotype ALPO4 (Berlinite) have
many physical properties in common, especially
the symmetry change at the α-β transition and
the microdomain structure near the transition
temperature. We report on our elastic neutron
scattering results of the intermediate incommen-
surate phase of ALPO4 existing in a temperature
range of about 1.5 K between the α and the
β phase. The experiments were performed on the
triple axis spectrometer UNIDAS at the FRJ-2
reactor in Jülich using 0.25° collimation.
Crystals with typical dimensions of 2.5 x 2.5 x
20 mm³ were grown under hydrothermal conditions.
After having passed the α-β transition several
times, satellite reflections were observed in
the directions a*, b* and a* - b* in various
Brillouin zones. In particular,satellites corres-
ponding to directions of the modulation vector
q perpendicular to the reciprocal lattice vec-
tor Q exhibit large structure factors. The tem-
perature dependence of q, which indicates the
incommensurate character of this intermediate
phase has been determined unambigously. Within
the temperature interval of 1.5 K the satel-
lites display a linear shift from q = 0.02 up
to q = 0.038 reciprocal units with increasing
temperature.