

AD-A034 874

MASSACHUSETTS INST OF TECH CAMBRIDGE
PHASE TRANSITIONS IN LIQUID CRYSTALS. (U)
JAN 77 J D LITSTER

F/G 7/4

N00014-76-C-0088

NL

UNCLASSIFIED

| OF |

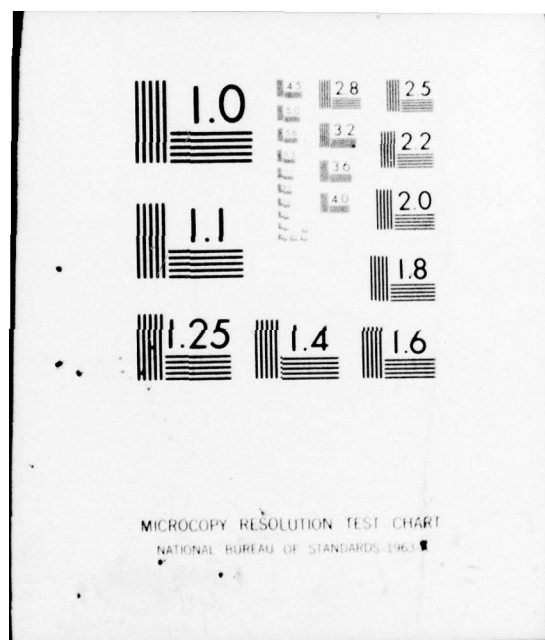
AD
A034874



END

DATE
FILMED

2-77



ADA 034874

Final Technical Report

Naval Research Contract N00014-76-C-0088

Expired: 30 June 1976

Principal Investigator: J. David Litster

A) Highlights of Accomplishments

At the beginning of the contract period (1972) the aim was to use quasi-elastic light scattering to study the nematic-isotropic transition in liquid crystals. The work supported showed this to be a weakly first order transition (as required by symmetry) with pre-transitional behavior quite analogous to that observed near critical points. The mean field approximation appears to satisfactorily explain these observations. These experiments have provided the basis for our understanding of this phase transition.

More recently studies were made of the smectic A-nematic transition in a material (cyanobenzylidene-octyloxyaniline) where it is second order. The smectic A phase is a further step along the way to solidification and the proposed model for this phase transition is mathematically isomorphous to the Ginsburg-Landau model of superconductivity. The results of our experiments were interesting because, contrary to previous work, they showed an inconsistency between the model and the scaling law hypothesis. This work continues under NSF sponsorship; perhaps this is more appropriate in view of its basic nature.

In summary, the work supported under this contract contributed substantially to our fundamental knowledge of liquid crystals and towards testing current ideas in statistical mechanics.

B) Degrees Awarded (Partial Support from this Contract)

Theodore R. Steger Ph.D. (1974)

Henryk Birecki Ph.D. (1976)

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM																		
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER																		
4. TITLE (and Subtitle) PHASE TRANSITIONS IN LIQUID CRYSTALS.		5. TYPE OF REPORT & PERIOD COVERED Final Technical Report, 1 Jul 1972 - 30 June 1976,																		
7. AUTHOR(s) J. N. LITSTER David		8. CONTRACT OR GRANT NUMBER(s) NO0014-76-C-0088, NEW NO0014-67-A-0204-0062																		
9. PERFORMING ORGANIZATION NAME AND ADDRESS Massachusetts Institute of Technology Cambridge, MA 02139		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR396-011 121107																		
11. CONTROLLING OFFICE NAME AND ADDRESS 123P.		12. REPORT DATE 20 January 1977																		
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Office of Naval Research Code 421 / Physical Sciences Division		13. NUMBER OF PAGES Two (2)																		
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		15. SECURITY CLASS. (of this report) Unclassified																		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE																		
18. SUPPLEMENTARY NOTES		<table border="1"> <tr> <td colspan="2">APPROVED BY</td> </tr> <tr> <td>YES</td> <td>With Section ☒</td> </tr> <tr> <td>NO</td> <td>With Section ☐</td> </tr> <tr> <td colspan="2">UNAPPROVED ☐</td> </tr> <tr> <td colspan="2">JUSTIFICATION</td> </tr> <tr> <td colspan="2">BY</td> </tr> <tr> <td colspan="2">DISTRIBUTION/AVAILABILITY CODE</td> </tr> <tr> <td>ONE</td> <td>THAN ONE</td> </tr> <tr> <td>A</td> <td></td> </tr> </table>	APPROVED BY		YES	With Section ☒	NO	With Section ☐	UNAPPROVED ☐		JUSTIFICATION		BY		DISTRIBUTION/AVAILABILITY CODE		ONE	THAN ONE	A	
APPROVED BY																				
YES	With Section ☒																			
NO	With Section ☐																			
UNAPPROVED ☐																				
JUSTIFICATION																				
BY																				
DISTRIBUTION/AVAILABILITY CODE																				
ONE	THAN ONE																			
A																				
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) LIQUID CRYSTALS, LIGHT SCATTERING, NEMATIC-ISOTROPIC TRANSITION, SMECTIC NEMATIC TRANSITION.																				
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report summarizes the results of light scattering studies of the nematic-isotropic and smectic A-nematic phase transitions in liquid crystals. Reference to ten resulting publications is given.																				

Gareth Williams	Ph.D.	} anticipated 1977
Greg Blonder	S.B.	
Mark Menser	S.B.	

A thesis was written, or will be written, for each of the above degrees.

C) Publications of Work Supported by this Contract

1. "Static and Dynamic Behavior Near the Order-Disorder Transition of Nematic Liquid Crystals", (with T. W. Stinson and N. A. Clark), *J. de Physique* 33, colloque C-1, 69 (1972).
2. "Correlation Range of Fluctuations of Short-Range Order in the Isotropic Phase of a Liquid Crystal", (with T. W. Stinson), *Phys. Rev. Letters* 30, 688 (1973).
3. "Brillouin Scattering in the Isotropic Phase of MBBA", (with T. R. Steger, Jr.), *Proceedings of American Chemical Society Symposium on Ordered Fluids and Liquid Crystals*, Chicago (1973).
4. "Pretransitional Behavior in the Isotropic Phase of Homologous Compounds Showing Nematic and Smectic C Type Order", (with T. R. Steger, Jr. and W. R. Young), *Proceedings of ACS Symposium on Ordered Fluids and Liquid Crystals*, Chicago (1973).
5. "Liquid Crystals" in *Photon Correlation and Light Beating Spectroscopy*, ed. by H. Z. Cummins and E. R. Pike (pp. 475-491), Plenum, New York (1974).
6. "Recent Advances in Liquid Crystals", (with G. Durand) in *Annual Review of Materials Science*, Vol. III (1973), edited by R. A. Huggins.
7. "Stability of Lipid Bilayers and Red Blood Cell Membranes", *Physics Letters* 53A, 193 (1975).
8. "Light Scattering Study of Director Fluctuations in the Smectic A Phase of CBOOA", (with H. Birecki, R. Schaetzing, and F. Rondelez), *Third International Conference on Light Scattering in Solids*, Campinas, Brazil 1975, ed. by M. Balkanski, R. C. C. Leite and S. P. S. Porto (pp. 707-712).
9. "Light Scattering Study of a Smectic A Phase near the Smectic A-Nematic Transition", (with H. Birecki, R. Schaetzing, and F. Rondelez), *Physical Review Letters*, 36, 1376 (1976).
10. "Director Bend Mode Behavior Near a Nematic to Smectic-A Phase Transition", (with H. Birecki), *Mol. Cryst. and Liquid Cryst.*, to be published.