<table>
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<th>Report Title: Propagation of Sound in Matter</th>
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<td>Contract N00014-75-C-0246</td>
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**Performing Organization: University of California, Los Angeles, CA 90024**

**Abstract:**


**Keywords:** Solitons, subharmonics, quasiperiodic, phase lock porous media, 1st and 4th sound, superfluid, sound scattering.
FINAL REPORT

NO0014-75-C-0246

2/2/82 - 12/31/84

PROPAGATION OF SOUND IN MATTER

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February 1985
The following Final Report covers the period February 2, 1982 to December 31, 1984 during which period research was conducted under Task Order N00014-75-C-0246. There is an Interim Summary Report covering N00014-67-A-0111-0019, N00014-69-A-0200-4014 and N00014-75-C-0246 between the dates 10/1/68 - 2/1/82. There also exists a Final Report covering research under Task Order 233(48) which is available on request.
LIST OF THOSE WHO RECEIVED SUPPORT ON ONR CONTRACTS FROM 2/2/82 TO 12/31.84 AND OBTAINED Ph.D. DEGREE IN PHYSICS INCLUDING THEIR PRESENT PROFESSIONAL POSITIONS.


LIST OF TECHNICAL REPORTS


LIST OF PUBLICATIONS


84. An Upper Division Student Laboratory Experiment which Measures the Velocity Dispersion and Nonlinear Properties of Gravitational Surface Waves in Water, Junru Wu and Isadore Rudnick, accepted for publication in the American Journal of Physics.


61. Discovery of a Non-Propagating Self-trapped Hydrodynamic Soliton.

   We have discovered a hydrodynamic soliton which is trapped by its own unique properties. Theory and experiment are in excellent agreement.


   When the normal component of superfluid helium is progressively locked by increasing the flow resistance of the superleak first sound becomes fourth sound and second sound becomes a non-propagating diffusive wave. The absorption and dispersion which accompany these transitions was studied experimentally and theoretically and good agreement is found. Multiple scattering occurs when fluid or fourth sound propagates in a superleak, and such systems offer an ideal opportunity to test scattering theories (Publ. 82). This is Steve Baker's Ph.D. thesis. We should be issuing a Technical Report in three or four months.

NOTES ON TECHNICAL DESCRIPTION OF RESEARCH COMPLETED

Item 50 in the Research Completed list is treated in publications 80 and 83.

Item 52 in Research Completed list is further developed in publications 87 and 88.

Items 35 and 38 in Research Completed list contains a description of an annulus partially packed with superleak and containing superfluid helium. This system has proved to have considerable utility and has been used to study persistent currents in bulk helium (Publ. 35), the trapping of persistent currents in superleaks (Publ. 38), persistent currents in films (Publ. 51). The theory of the acoustic modes of this system is developed in Publications 38, 41 and 79. Publication 79 has the most exact result.
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