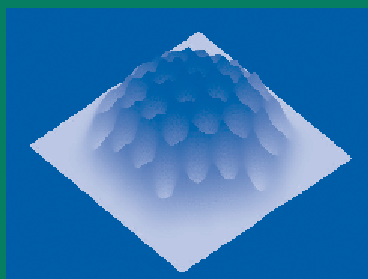


Progress in Nonlinear Differential Equations
and Their Applications

Amandine Aftalion

Vortices in Bose–Einstein Condensates



Birkhäuser

Special Discount

Vortices in Bose–Einstein Condensates

Author:

Amandine Aftalion

*CNRS, Laboratoire Jacques-Louis Lions,
Université Paris 6, Paris, France*

Since the first experimental achievement of Bose–Einstein condensates (BEC) in 1995 and the award of the Nobel Prize for Physics in 2001, the properties of these gaseous quantum fluids have been the focus of international interest in condensed matter physics. This monograph is dedicated to the mathematical modeling of some specific experiments which display vortices and to a rigorous analysis of features emerging experimentally.

In contrast to a classical fluid, a quantum fluid such as a Bose–Einstein condensate can rotate only through the nucleation of quantized vortices beyond some critical velocity. There are two interesting regimes: one close to the critical velocity where there is only one vortex that has a very special shape; and another one at high rotation values, for which a dense lattice is observed.

One of the key features related to superfluidity is the existence of these vortices. We address this issue mathematically and derive information on their shape, number and location. In the dilute limit of the experiments, the condensate is well described by a mean field theory and a macroscopic wave function solving the so-called Gross–Pitaevskii equation. The mathematical tools employed are energy estimates, Gamma convergence, and homogenization techniques. We prove existence of solutions that have properties consistent with the experimental observations. Open problems related to recent experiments are presented.

The work can serve as a reference for mathematical researchers and theoretical physicists interested in superfluidity and quantum condensates, and can also complement a graduate seminar in elliptic PDEs or modeling of physical experiments.

To be published by Birkhäuser Boston

Expected Release: May 2006

©2006 / Approx. 218 pp. / Hardcover / PNLDE, v.67

ISBN 0-8176-4392-3 / List Price \$99.00 (tent.)

Table of Contents

Preface

* The Physical Experiments and Their Mathematical Modeling

* The Mathematical Setting: A Survey of the Main Theorems

* Two-dimensional Model for a Rotating Condensate

* Other Trapping Potentials

* High Velocity and Quantum Hall Regime

* Three-dimensional Rotating Condensate

* Superfluid Flow around an Obstacle

* Further Open Problems

References

Index

****Special 20% Discount: US\$79.20****

valid until April 30, 2006

ORDER FORM

Four Easy Ways to Order

Call: (800) 777-4643 (within North & South America)
(212) 460-1500 (outside North & South America)
Fax: (201) 348-4505
Mail: Birkhäuser, PO Box 2485, Secaucus, NJ 07096
Online: www.birkhauser.com

YES, Please send me (upon publication):

Vortices in Bose–Einstein Condensates
PNLDE, v.67
by Amandine Aftalion
ISBN 0-8176-4392-3

At the Special Price of **\$79.20** + shipping & handling
List Price: US\$99.00 (tent.)

Qty: ____ @ US\$79.20 each _____

Sub Total: _____

Sales Tax: _____

NY, NJ, CA, VT, IL, PA, TX, MO, MA & VA.
Canadian Residents, please add 7% GST.

Shipping & Handling: _____

\$5.00 for the first & \$1.00 for each additional book

(within North and South America);

\$10.00 for the first & \$5.00 for each additional book
(outside North and South America)

Total: _____

PAYMENT METHOD

- Purchase Order #
 Check Enclosed
 Credit Card (please check one)
 Master Card Visa
 American Express Discover

Card No.: _____

Exp. Date: _____

Signature: _____

Date: _____

20% Discount Special Offer

List Price: US\$99.00 (tentative)

Special Price: **\$79.20** + shipping and handling

Please mention reference **#BB065**
when placing your order!
Offer Valid Until April 30, 2006

SATISFACTION GUARANTEED!

*Remember: Your 30-Day return privilege
is always Guaranteed!*

Payment can be made by check, money order or credit card. Prices are valid in North America only, payable in U.S. currency or its equivalent, and are subject to change without notice.

SHIPPING INFORMATION

Name

Address

City

State

Zip

Telephone/E-mail

TO ORDER

Call: (800) 777-4643 (within North & South America)
(212) 460-1500 (outside North & South America)

Fax: (201) 348-4505

Mail: Birkhäuser, PO Box 2485, Secaucus, NJ 07096

Online: www.birkhauser.com

Please mention promotion **#BB065** when ordering!