Universidade de São Paulo
Instituto de Física de São Carlos

XII Semana Integrada do Instituto de Física de São Carlos

Livro de Resumos

São Carlos
2022

Semana Integrada do Instituto de Física de São Carlos

SIFSC 12

Coordenadores

Prof. Dr. Osvaldo Novais de Oliveira Junior
Diretor do Instituto de Física de São Carlos – Universidade de São Paulo

Prof. Dr. Javier Alcides Ellena
Presidente da Comissão de Pós Graduação do Instituto de Física de São Carlos – Universidade de São Paulo

Profa. Dra. Tereza Cristina da Rocha Mendes
Presidente da Comissão de Graduação do Instituto de Física de São Carlos – Universidade de São Paulo

Comissão Organizadora

Adonai Hilario
Arthur Deponte Zutião
Elisa Goettems
Gabriel dos Santos Araujo Pinto
Henrique Castro Rodrigues
Jefter Santiago Mares
João Victor Pimenta
Julia Martins Simão
Letícia Martinelli
Lorany Vitoria dos Santos Barbosa
Lucas Rafael Oliveira Santos Eugênio
Natasha Mezzacappo
Paulina Ferreira
Vinícius Pereira Pinto
Willian dos Santos Ribela

Normalização e revisão – SBI/IFSC

Ana Mara Marques da Cunha Prado
Maria Cristina Cavarette Dziabas
Maria Neusa de Aguiar Azevedo
Sabrina di Salvo Mastrantonio

Ficha catalográfica elaborada pelo Serviço de Informação do IFSC

Semana Integrada do Instituto de Física de São Carlos
(12: 10 out. - 14 out. : 2022: São Carlos, SP.)
Livro de resumos da XII Semana Integrada do Instituto de Física de São Carlos/ Organizado por Adonai Hilario [et al.]. São Carlos: IFSC, 2022.
446 p.
Texto em português.
1. Física. I. Hilario, Adonai, org. II. Titulo

ISBN: 978-65-993449-5-4 CDD: 530

PG61

Excitation of Bose-Einstein condensates with temporal resolution in separate zones

MACHADO, Leandro Alvares; MADEIRA, Lucas; SANTARELLI, Monica Caracanhas; BAGNATO, Vanderlei Salvador; MIDDELETON-SPENCER, Holly; GALANTUCCI, Luca; BARENGHI, Carlo F.

lemachado@usp.br

Bose-Einstein condensates (BECs) produced with trapped atoms, are very well controlled quantum systems. In the literature, studies on equilibrium BEC are well-consolidated. On the other hand, when we consider BECs in the non-equilibrium regime, there is still a lot to be understood. The dynamics of out of equilibrium quantum systems, are at the frontier of knowledge. BECs are extraordinary physical systems to study quantum aspects of many-body physics. The evolution of these systems, when externally excited, present interesting properties due to its quantum character, like the collective modes and the generation of quantized vortices. (1) Even more, for strongly excited samples, BECs may reach the quantum turbulence regime. (2) Our physical system is characterized by a BEC sample confined in a harmonic oscillator trap and its externally excited by an oscillatory magnetic field that introduce perturbations and nonlinearities. Our group has several works in this direction, but always using the same approach to excite the BEC samples, that is, using a single pulse. Now, we are interested in studying these systems with separate zones excitations instead of just a single pulse. This proposal of excitation is motivated by Norman F. Ramsey experiment (3), which introduced the separate oscillatory field method to promote atomic transitions between hyperfine states of atoms and it had important applications in atomic clocks and modern interferometry. Similarly to the Ramsey's experiment, we expect that interference phenomenon should appear in our quantum many-body system. From recent results, we already noted interference phenomenon in the collective modes evolution, like Ramsey fringes. For strongly excited samples using the Ramsey-like excitation, we expect to be able to analyze the persistence of coherence in these samples, indicating if the system becomes more disordered or not with application of perturbations. Thus, the proposal of this work is the development of theoretical models and the elaboration of computer simulations that will reproduce the experiments that are currently being carried out. These theoretical studies will allow us to better understand the behavior of this system, and its response to external excitations.

Palavras-chave: Bose-Einstein condensates. Quantum turbulence. Ramsey excitation.

Agência de fomento: CAPES (Não se aplica)

Referências:

1 PETHICK, C. J.; SMITH, H.. **Bose–Einstein condensation in dilute gases** .Cambridge: Cambridge University Press, 2008.

2 MIDDLETON-SPENCER, H. A. J. *et al* . **Evidence of strong quantum turbulence in Bose Einstein condensates** .2022. Disponivel em:arXiv preprint arXiv:2204.08544. Acesso em: 06.09.2022.

3 RAMSEY, N. F. Experiments with separated oscillatory fields and hydrogen masers. **Reviews of**

Modern Physics , v. 62, n. 3, p. 541, 1990.