Localized Excitations in Nonlinear Complex Systems

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Book of Abstracts

Quantum Double Helix

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The double helix is an intrinsic geometry of proteins [1]. The analogous double helix structures were reported recently for dusty plasmas [2] and for the interference of the phase-conjugated speckle fields in Brillouin scattering [3]. The helical wavefronts around phase singularities [4] of the optical speckle fields were shown to form the spiral structures in Brillouin medium. This process is not accompanied by change of photon's *helicity* [5], but orbital component of the angular momentum (OAM) $L_z = \hbar$ is overturned. The conservation of angular momentum requires as a must an excitation of a spiral acoustical phonon [6] with doubled vorticity and doubled OAM $2\hbar$ [3].
In classical picture spiral acoustical phonons form the circular flow around phase singularity. The whole picture in inhomogeneous speckle field is composed of randomly spaced optical vortex-antivortex pairs with collocated acoustical vortices [7]. The reflection of light beams via nondegenerate four-wave mixing from ultracold atomic cloud had been reported to form corkscrew interference pattern in cloud and rotational motion of cold matter around phase singularity [8].
The goal of present communication is in consideration of the disordered bosonic cloud with coherent backscattering from random medium[9]. The "envelope" complex amplitudes of Heisenberg annihilation operators [5] for optical pump wave $\hat{\Psi}_p(z,r,\phi,t)$ moving in positive direction of z-axis and Stockes wave $\hat{\Psi}_s(z,r,\phi,t)$ moving in negative direction of z-axis are described by the following system of equations:

$$\frac{\partial \hat{\Psi}_p}{\partial z} + \frac{n}{c}\frac{\partial \hat{\Psi}_p}{\partial t} + \frac{i}{2k_p}\Delta_\perp \hat{\Psi}_p = \frac{i\gamma\omega_p}{4\rho_0 nc}\hat{\Phi}\,\hat{\Psi}_s\,, \tag{1}$$

$$\frac{\partial \hat{\Psi}_s}{\partial z} - \frac{n}{c}\frac{\partial \hat{\Psi}_s}{\partial t} - \frac{i}{2k_s}\Delta_\perp \hat{\Psi}_s = -\frac{i\gamma\omega_s}{4\rho_0 nc}\hat{\Phi}^*\hat{\Psi}_p\,, \tag{2}$$

The "envelope" annihilation operator $\hat{\Phi}(z,r,\phi,t)$ for bosonic matter-wave moving in positive direction of z-axis obeys to:

$$v_a\frac{\partial\,\hat{\Phi}}{\partial z} + \frac{\partial\,\hat{\Phi}}{\partial\,t} + \frac{\Gamma\hat{\Phi}}{2} = \frac{i\gamma k_a 2}{16\pi\Omega_a}\hat{\Psi}_p\hat{\Psi}_s^*, \tag{3}$$

The expectation value of matter-wave annihilation operator near phase singularity $\hat{\Phi}_{\text{twisted}}(z,r,\phi,t)$ is obtained as follows [3]:

$$<\hat{\Phi}>\approx<\hat{\Psi}_p\hat{\Psi}_s^*>\approx \exp\,[\,+i2\ell\,\phi\,]\,r^{2\ell}\,\exp\,[\,-\frac{2r2}{D2(1+z2/(k_p2D4))}]. \tag{4}$$

References

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Tuesday 14		Wednesday 15		Thusday 16		Friday 17	
8:45-9:00	Registration	8:45-9:00	Registration				
9:00-9:25	Presentation	9:00-9:25	F.M. Russell	9:00-9:25	B. Li	9:00-9:25	Yu.B. Gaididei
9:25-9:50	P.G. Kevrekidis	9:25-9:50	V. Dubinko	9:25-9:50	S. Flach	9:25-9:50	M.A. Porter
9:50-10:15	D.J. Frantzeskakis	9:50-10:15	J.C. Eilbeck	9:50-10:15	A. Aceves	9:50-10:15	Krishna Mohan
10:15-10:45	Coffee break	10:15-10:45	Coffee break	10:15-10:45	Coffee break	10:15-10:45	Coffee break
10:45-11:10	J. Cuevas	10:45-11:10	L. Cruzeiro	10:45-11:10	R. Carretero	10:45-11:10	J.F.R. Archilla
11:10-11:35	V. Rothos	11:10-11:35	A. Stefanov	11:10-11:35	R. Khomeriki	11:10-11:35	D. Cubero
11:35-12:00	D. Pelinovsky	11:35-12:00	N. Theodorakopoulos	11:35-12:00	G. Mazzarella	11:35-12:00	V. Koukouloyannis
12:00-12:15	Break	12:00-12:15	Break	12:00-12:15	Break	12:00-12:15	Break
12:15-12:40	V. M. Pérez-García	12:15-12:40	F. Fillaux	12:15-12:40	N.R. Quintero	12:15-12:40	M. Salerno
12:40-13:05	B.A. Malomed	12:40-13:05	L.Q. English	12:40-13:05	F.G. Mertens	12:40-13:05	V. Brazhnyy
13:05-13:30	E. Arévalo	13:05-13:30	E. Klotins	13:05-13:30	F. Renzoni	13:05-13:30	Yu. Bludov
13:30-15:45	Lunch	13:30-15:45	Lunch	13:30-15:45	Lunch	13:30-16:00	Lunch
15:45-16:10	E. Knobloch	15:45-16:10	T. Dobrowolski	15:45-16:10	A.R. Champneys	16:00-16:25	I. Barashenkov (2)
16:10-16:35	L. Gelens	16:10-16:35	P. Panayotaros	16:10-16:35	F.J. Díaz-Otero	16:25-16:50	M. García-Ñustes
16:35-17:00	D. Cuiñas-Vázquez	16:35-17:00	N. Karachalios	16:35-17:00	D. Gomila	16:50-17:20	Coffee Break
17:00-17:20	Coffee break	17:00-17:20	Coffee Break	17:00-17:20	Coffee Break	17:20-17:45	A. Okulov
17:20-17:45	D. Usero	17:20-17:45	Lj. Hadzievski	17:20-17:45	I. Barashenkov (1)	17:45-18:10	A. Figotin
17:45-18:10	C. Milián-Enrique	17:45-18:10	G. James	17:45-18:10	M.A. Alejo-Plana	18:10-18:30	Closing
21:00 -	Welcome Cocktail	21:00 -	Boat Trip	20:30-21:30	Visit to Alcázar		
				21:40 -	Conference Dinner		