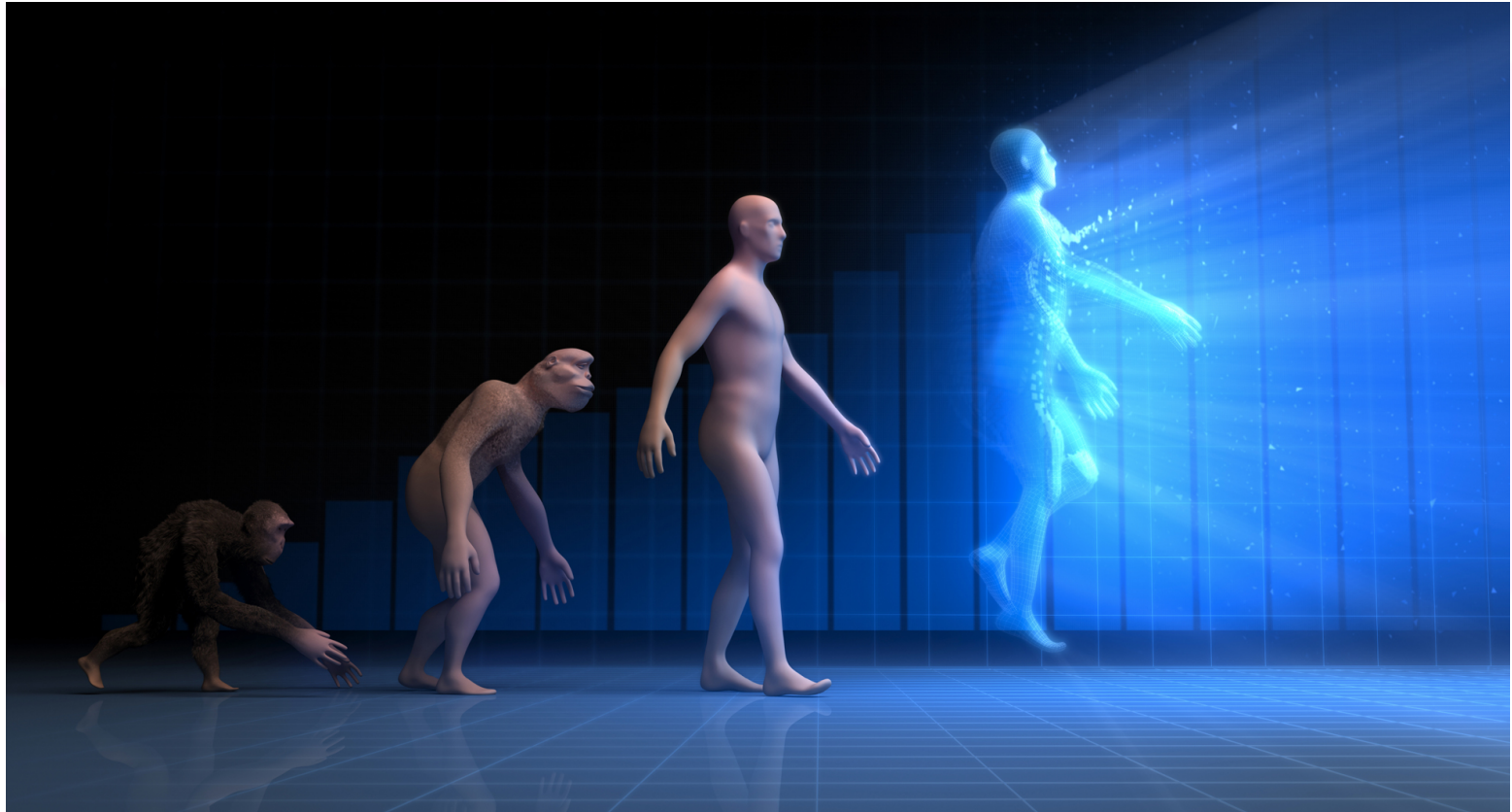


Article Evolution

Graham McCann

Article evolution is...



First online physics journal

The screenshot shows a Netscape browser window displaying the IOP Electronic Journals website. The browser's title bar reads "Netscape: Classical and Quantum Gravity". The website header features the IOP logo and the text "Electronic Journals". A navigation menu includes links for "Home", "Up", "Map", and "Feedback". Below this, a secondary menu lists "Online Services", "Journals", "Magazines", "Books & Reference", "Inside Physics", and "The Institute".

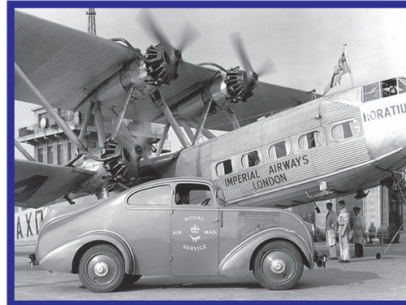
The main content area is titled "Classical and Quantum Gravity". It includes a "Forthcoming Articles" section with a link to "Latest issue: Volume 14, Number 11, November 1997 (L183-L186, 2971-3178)". A "Journal Archive" section contains a dropdown menu set to "Volume 14, 1997" and a "Go to volume" button. A "Journal Information" section provides details for authors, referees, and readers, including links to sample copies, ordering information, and editorial board details. A small image of the journal cover is displayed on the right side of the page.

At the bottom of the page, the ISSN number "ISSN: 0264-9381" is visible. A footer contains the text "Electronic Journals v2.0. Copyright IOP Publishing Ltd 1995, 1996, 1997. All rights reserved." and a "Filing Cabinet" button.

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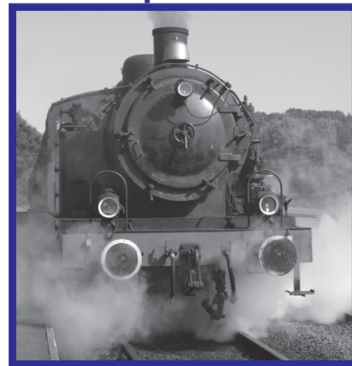
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1919



2011



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Concept: article as webpage

The screenshot shows a webpage for a journal article. At the top, there is a navigation bar for 'IOPscience' with options for 'Login', 'Create account', and 'Athens/Institutional login'. The journal title 'Journal of Physics: Condensed Matter' is prominently displayed. A search bar is located on the right, with a 'Quick search' button and a 'Find article' dropdown. Below the search bar, there are navigation links for 'Home', 'Search', 'Collections', 'Journals', 'About', 'Contact us', and 'My IOPscience'. The article title 'The phase diagram for coexisting d-wave superconductivity and charge-density waves: cuprates and beyond' is centered. Below the title, the authors' names are listed: Toshikazu Ekino¹, Alexander M Gabovich², Mai Suan Li³, Marek Pkkala⁴, Henryk Szymczak³ and Alexander I Voitenko². A 'Show affiliations' link is provided. The article's publication details include the journal name 'J. Phys.: Condens. Matter 23 385701', the DOI '10.1088/0953-8984/23/38/385701', and the dates 'Received 11 April 2011, in final form 15 July 2011' and 'Published 5 September 2011'. On the right side, there are social media sharing options for Email, Facebook, Twitter, Google+, Connotea, CiteULike, Bibsonomy, and a 'Share' button. A 'MathJax' status indicator is also present. Below the article title, there is a 'Contents' section with a list of sections: 'Abstract', '1. Introduction', '2. Theory', '3. Results of calculations', and '4. Conclusions'. There are also sections for 'Users also read', 'Related review articles', and 'Journal links'. At the bottom of the article, there is a 'BibTeX format (bib)' dropdown and an 'Export citation and abstract' button. The '1. Introduction' section begins with a paragraph discussing the pseudogap phenomenon in high- T_c superconductors.

Adding navigation

The screenshot displays the IOPscience website interface for the *Journal of Physics: Condensed Matter*. The page features a navigation bar at the top with options like 'Home', 'Search', 'Collections', 'Journals', 'About', 'Contact us', and 'My IOPscience'. A search bar is located in the top right corner. The main content area is titled 'The phase diagram for coexisting d-wave superconductivity and charge-density waves: cuprates and beyond' by Toshikazu Ekino et al. The article's abstract is visible, discussing phase diagrams of d-wave superconductivity. A sidebar on the left contains 'Browse figures' and 'References' sections. A right sidebar shows a 'Contents' table of contents and 'Users also read' section. At the bottom of the article, there is a 'BibTeX format (bib)' dropdown menu and an 'Export citation and abstract' button.

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The phase diagram for coexisting d-wave superconductivity and charge-density waves: cuprates and beyond

Toshikazu Ekino¹, Alexander M Gabovich², Mai Suan Li³, Marek Pękala⁴, Henryk Szymczak³ and Alexander I Voitenko²

Show affiliations

Toshikazu Ekino et al 2011 *J. Phys.: Condens. Matter* 23 385701
doi:10.1088/0953-8984/23/38/385701
Received 11 April 2011, in final form 15 July 2011
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Abstract

Phase diagrams of d-wave superconductivity characterized by an order parameter Δ coexisting with charge-density waves (CDWs) characterized by an order parameter Σ were constructed for the two-dimensional Fermi surface (FS) appropriate to, e.g., cuprates. CDWs were considered as an origin of the pseudogap appearing at antinodal FS sections of the $d_{x^2-y^2}$ superconductor. Two types of the Σ -reentrance were found: with the temperature, T , and with the opening of the CDW sector, $2a$. The angular plots in the momentum space for the resulting gap profile over the FS (gap roses) were obtained. The gap patterns are rather involved, giving insight into the difficulties of the interpretation of photoemission spectra. It was shown that the Σ - Δ coexistence region exists even for the complete dielectric gapping due to the distinction between the superconducting and CDW order parameter symmetries. The checkerboard and unidirectional CDW configurations were examined, and both the phase diagrams and the behavior with T and a of the order parameters were found to differ. A more general case with a non-zero mismatch angle β between the superconducting lobes and the CDW sectors was analyzed, the case $\beta = \pi/4$ corresponding to the d_{xy} symmetry of the superconducting order parameter. The phase diagrams were found to be sensitive to β -variations, showing that internal strains and external pressure can drastically affect the behavior of $\Sigma(T)$ and $\Delta(T)$.

BibTeX format (bib) Export citation and abstract

1. Introduction

The pseudogap phenomenon is one of the most involved scientific problems in the physics of high- T_c superconductors. At the same time, it remains rather a disappointing issue [1–4], since the lack of consensus concerning the pseudogap nature means the absence of a consistent theory of superconductivity after 25 years of enormous collective efforts (see books and reviews describing various contradicting accounts of the state of art [5–10]). Therefore, it is no wonder that nobody can successfully predict new superconductors and calculate their critical temperatures [11]. Nevertheless, it is conventionally agreed that all versatile theories and concepts concerning pseudogaps can be divided into two categories: (i) theories based on the concept of precursor (fluctuating) superconductivity [12, 13], which may be transformed below the superconducting critical temperature T_c either into the Bardeen–Cooper–Schrieffer-like (BCS-like) [14, 15] or Bose–Einstein-like [16, 17] superfluid states, and (ii) theories of competing order [12, 18–22]. There are also a few hybrid approaches [23].

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[Hide affiliations](#)

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¹ Graduate School of Integrated Arts and Sciences, Hiroshima University, Higashi-Hiroshima, 739-8521, Japan

² Institute of Physics, National Academy of Sciences of Ukraine, 46, Nauka Avenue, Kyiv 03680, Ukraine

³ Institute of Physics, Aleja Lotników 32/46, PL-02-668 Warsaw, Poland

⁴ Department of Chemistry, University of Warsaw, Aleja Żwirki i Wigury 101, PL-02-089 Warsaw, Poland

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CrossRef

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characterized by an order parameter z were constructed for the two-dimensional Fermi surface (FS) appropriate to, e.g., cuprates. CDWs were considered as an origin of the pseudogap appearing at antinodal FS sections of the $d_{x^2-y^2}$ superconductor. Two types of the coexistence were found: with the temperature, T_c , and with the opening of the CDW sector, z_c . The angular plots in the momentum space for the resulting gap profile over the FS (gap roses) were obtained. The gap patterns are rather involved, giving insight into the difficulties of the interpretation of photoemission spectra. It was shown that the $Z=0$ coexistence region exists even for the complete dielectric gapping due to the distinction between the superconducting and CDW order parameter symmetries. The checkerboard and unidirectional CDW configurations were examined, and both the phase diagrams and the behavior with T_c and z_c of the order parameters were found to differ. A more general case with a non-zero mismatch angle β between the superconducting lobes and the CDW sectors was analyzed, the case $\beta = \pi/4$ corresponding to the d_{xy} symmetry of the superconducting order parameter. The phase diagrams were found to be sensitive to β -variations, showing that internal strains and external pressure can drastically affect the behavior of $Z(T)$ and $Z(T_c)$.

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The pseudogap phenomenon is one of the most involved scientific problems in the physics of high- T_c superconductors. At the same time, it remains rather a disappointing issue [1–4], since the lack of consensus concerning the pseudogap nature means the absence of a consistent theory of superconductivity describing various contradicting accounts of the state of new superconductors and calculate their critical temperatures and concepts concerning pseudogaps can be of (fluctuating) superconductivity [1, 13], which may be Bardeen–Cooper–Schrieffer-like (BCS-like) [4, 15] or B order [12, 16–17]. There are also a few hybrid approaches and reviews in successfully predict that all versatile concept of precursor state T_c either into the theories of competing

References

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The phase diagram for coexisting d-wave superconductivity and charge-density waves: cuprates and beyond

Toshikazu Ekino¹, Alexander M Gabovich², Mai Suan Li³, Marek Pękala⁴, Henryk Szymczak³ and Alexander I Voitenko²

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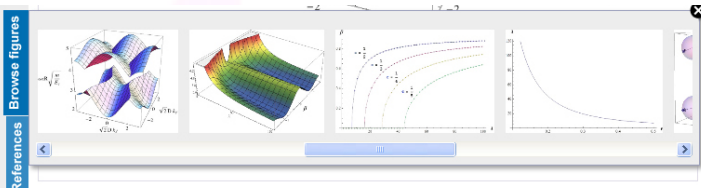
Abstract

Phase diagrams of d-wave superconductivity characterized by an order parameter Δ coexisting with charge-density waves (CDWs) characterized by an order parameter Σ were constructed for the two-dimensional Fermi surface (FS) appropriate to, e.g., cuprates. CDWs were considered as an origin of the pseudogap appearing at antinodal FS sections of the $d_{x^2-y^2}$ superconductor. Two types of the Σ -reentrance were found: with the temperature, T , and with the opening of the CDW sector, 2α . The angular plots in the momentum space for the resulting gap profile over the FS ('gap roses') were obtained. The gap patterns are rather involved, giving insight into the difficulties of the interpretation of photoemission spectra. It was shown that the Σ - Δ coexistence region exists even for the complete dielectric gapping due to the distinction between the superconducting and CDW order parameter symmetries. The checkerboard and unidirectional CDW configurations were examined, and both the phase diagrams and the behavior with T and α of the order parameters were found to differ. A more general case with a non-zero mismatch angle β between the superconducting lobes and the CDW sectors was analyzed, the case $\beta = \pi/4$ corresponding to the dx_{xy} symmetry of the superconducting order parameter. The phase diagrams were found to be sensitive to β -variations, showing that internal strains and external pressure can drastically affect the behavior of $\Sigma(T)$ and $\Delta(T)$.

1. Introduction

The pseudogap phenomenon is one of the most involved scientific problems in the physics of high- T_c

Graphics Carousel



3.2. Quantum phase transition

It is not *a priori* obvious what will happen in the quantum mechanical case at zero temperature, since the quantum confinement introduces a new energy scale. Rather than solve for the variational ground state of an $N \times N$ system directly, it was assumed that the quantum ground state would possess the same symmetry as the classical system, so that only a 2×2 unit cell of an (assumed) infinite system was analyzed. This has the advantage of following the correspondence principle as $\lambda \rightarrow \infty$. A plot of the variational energy for $\epsilon = \frac{1}{2}$, reveals that, at small values of the coupling constant, λ , a single minimum exists, figure 6. This minimum corresponds to $\beta = 0$, i.e. a uniform distribution for the electronic wavefunction. As λ increases past a critical value, two new minima emerge at $\beta = \pm \frac{\pi}{4}$, indicating a quantum phase transition. These values correspond to charge localizing normal to the plane. Furthermore, nearest neighbors polarize in opposite directions.

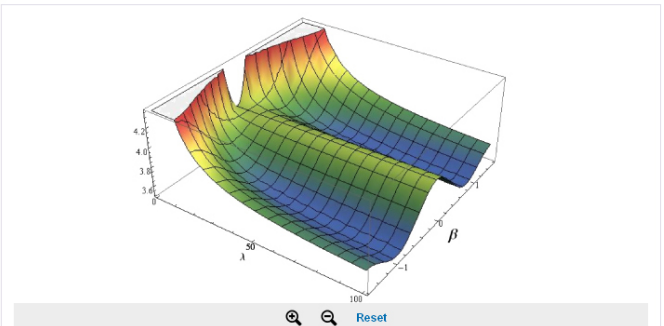


Figure 6. A plot of the energy functional from the quantum variational calculation for the 2D square lattice. Here, $\epsilon = \frac{1}{2}$, thus the ratio of shell radius to separation is at a maximum (the close-packed condition). A single minimum for small values of the coupling constant, λ , occurs at $\beta = 0$, where β is the mixing parameter found in the variational wavefunction. This state corresponds to a uniform charge distribution. As λ increases, two minima emerge at $\beta = \pm \frac{\pi}{4}$. These values correspond to charge localizing normal to the plane of the lattice.

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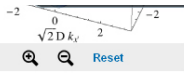


Figure 5. A plot of two of the eigenfrequencies of the AFE square lattice as a function of wavevector. The surface has been displaced upwards by one unit for clarity. Without the displacement the normal modes are equivalent to those plotted, but rotated by $\pi/2$. Note that all modes are symmetric about the center.

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3.2. Quantum phase transition

It is not *a priori* obvious what will happen in the quantum mechanical case at zero temperature. The introduction of a new energy scale. Rather than solve for the variational ground state of an N particle system, the quantum ground state would possess the same symmetry as the classical system, if the (assumed) infinite system was analyzed. This has the advantage of following the correct variational energy for $\epsilon = \frac{1}{2}$, reveals that, at small values of the coupling constant, λ , a single minimum corresponds to $\beta = 0$, i.e. a uniform distribution for the electronic wavefunction. As λ increases, two new minima emerge at $\beta = \pm \frac{\pi}{4}$, indicating a quantum phase transition. These values correspond to charge localizing normal to the plane. Furthermore, nearest neighbors polarize in opposite directions.

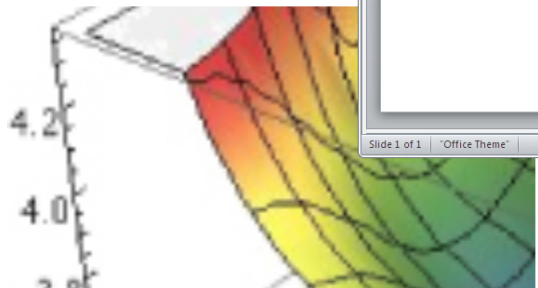


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Figure 6 from Anti-ferroelectric polarization transitions in quantum-dot-quantum-well arrays
E Brown and K.J. Mullen 2011 J. Phys.: Condens. Matter 23 455301 doi:10.1088/0953-8984/23/45/455301

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Maths is a big deal in physics

Handwritten notes on a chalkboard:

$\partial u |_{x=x_0, x=}$

Feynman

$$\frac{1}{(2\pi)^2} \int_{-\infty}^{+\infty} dx \int_{-\infty}^{+\infty} dt e^{-i(kx - \omega t)}$$

Other Abstracts

New Journal of Physics > Volume 13 > November 2011

The role of glassy dynamics in the anomaly of the dielectric function of solid helium

Jung-Jung Su^{1,2,3,4}, Matthias J Graf¹ and Alexander V Balatsky^{1,2}
[Show affiliations](#)

Jung-Jung Su *et al* 2011 *New J. Phys.* **13** 113024
doi:10.1088/1367-2630/13/11/113024
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Abstract

We propose that the acousto-optical (electro-elastic) coupling of the electric field to strain fields localized around defects in disordered ⁴He causes an increase of the dielectric function with decreasing temperature due to the arrested dynamics of defect excitations. A distribution of such low-energy excitations can be described within the framework of a glass susceptibility of a small volume fraction inside solid ⁴He. Upon lowering the temperature the relaxation time $\tau(T)$ of defects increases and an anomaly occurs in the dielectric function $\epsilon(\omega, T)$ when $\omega\tau(T) \sim 1$. Since $\epsilon(\omega, T)$ satisfies the Kramers–Kronig relation, we predict an accompanying peak in the imaginary part of $\epsilon(\omega, T)$ at the same temperature that the largest change in amplitude occurs at a fixed frequency. We also discuss recent measurements of the amplitude of the dynamic dielectric function that indicate a low-temperature anomaly similar to that seen in the resonance frequency of the torsional oscillator and shear modulus experiments.

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GENERAL SCIENTIFIC SUMMARY

Introduction and background. Since the discovery of anomalous behavior of solid ⁴He below 200 mK, it has been believed that helium enters into an exotic phase of matter—a supersolid, which is a quantum state that exhibits superflow and crystalline order at the same time. This finding revitalized the quest for supersolidity in quantum solids. At the same time, an increasing number of follow-up experiments showed that defects are critical for observing these anomalies. The central debate is then whether defects merely enhance the supersolidity phenomenon, or if they exhibit their own dynamics, which dominate at low temperatures. Addressing this question requires a thorough understanding of glassy dynamics and the dynamics of correlated defects.

Main results. We consider the effects of defects and their glassy dynamics on the dynamic dielectric function. We postulate that local defects create short-ranged strain fields that contribute to the dielectric function through acousto-optical or electro-elastic coupling. We obtain the dynamic behavior of the dielectric function anomaly whose magnitude is consistent with recent experiments. Moreover, we predict the existence of an accompanying dissipation peak, which is the signature of defects' glassy dynamics.

Wider implications. The proposed model of glassy defect dynamics successfully describes the low-temperature anomalies of solid helium. It may be further generalized to other nonconventional glass systems with frozen-in nonequilibrium configurations.

1. Introduction

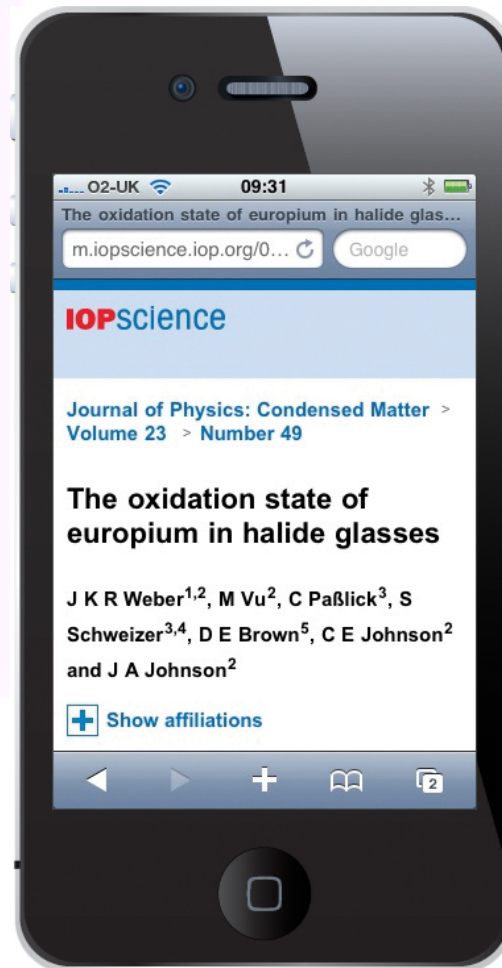
The reported anomalies in resonance frequency and dissipation of torsional oscillators [1–9] and in the dynamic shear modulus [10–12] at low temperatures are the subject of intensive study as they have been suggested to be signatures of supersolidity. It is now generally agreed that disorder plays an essential role in observing these effects. The challenge in

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Video Abstracts

The screenshot displays the New Journal of Physics website interface. At the top, there is a navigation bar with options like 'Login', 'Create account', and 'Athens/Institutional login'. A search bar is prominently featured with a 'Search' button. Below the navigation, the journal's name 'New Journal of Physics' and its tagline 'The open-access journal for physics' are visible. The main content area features the article title 'The role of glassy dynamics in the anomaly of the dielectric function of solid helium' by Jung-Jung Su, Matthias J Graf, and Alexander V Balatsky. The article's abstract is partially visible, discussing the acousto-optical coupling of the electric field to strain fields. A video abstract player is embedded in the article, showing a play button and a video player interface. The video title is 'Video Abstract: Nonlocal restoration of two-m...'. Below the video player, there are links for 'Download this video', 'Transcript of this video', and 'View all New J. Phys. video abstracts'. The website also includes a sidebar with 'References' and 'Browse figures' sections, and a right-hand sidebar with 'Contents', 'Users also read', and 'Journal links' sections.

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Graham McCann, graham.mccann@iop.org



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