Fulvio Bisi
Curriculum Vitae et Studiorum

Name/Surname (Nome/Cognome): Fulvio Bisi
Place of birth: Milano
Date of birth: 17 January 1962
Citizenship: Italian
Office Address: Dipartimento di Matematica, via Ferrata, 1 - 27100 Pavia (Italy)
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1981	Student with Fellowship at the Scuola Normale Superiore, Pisa (Italy)
1987	Degree in Physics on July 23rd(summa cum laude) from the University of Pisa (Italy)
1998	Diploma di Perfezionamento in Fisica (PhD in Physics, summa cum laude) from the Scuola Normale Superiore – Pisa (Italy)
1999-2002	Post Doc fellowship from Politecnico di Milano – Department of Mathematics
2002-2015	Ricercatore (Researcher/Assistant Professor) in Mathematical Physics, Department of Mathematics, University of Pavia (Italy).
2004-05	(25 Sep-9 Oct) Invited Fellow at the Institute for Mathematics and its Applications), University of Minnesota, Minneapolis (USA)
2006	(15-21 Nov) Invited Fellow at the School of Mathematics, University of Southampton, Southampton (UK)
2008	(16 Mar-26 Apr) Invited Fellow at the Department of Mathematical Sciences, Kent State University, Kent (OH-USA)
2009	(24-29 Mar) Invited Fellow at the Department of Mathematics, University of Strathclyde, Glasgow (UK)
2013	(7-11 Jan, 3-28 Mar) Invited Participant in the Programme “The Mathematics of Liquid Crystals”, Isaac Newton Institute for Mathematical Sciences, Cambridge (UK).
2015-present	Professore Associato (Associate Professor) in Mathematical Physics, Department of Mathematics, University of Pavia (Italy).

Known Languages

English:
First Certificate in English (Cambridge FCE)- June 1999 – Cert. Grade A
Certificate in Advanced English (Cambridge CAE) – June 2000 - Cert. Grade A
Certificate of Proficiency in English (Cambridge CPE) – June 2001 - Cert. Grade A

French-Français
DELF (Diplôme d'études en langue française) B1 – November 2006
DALF (Diplôme approfondi de langue française) C1 – June 2007

Spanish-Español
D.E.L.E. (Diploma Básico de Español como Lengua Extranjera) – November 2000 (91.41/100)

Portuguese (Português)
B2 course Oct 2022 - Feb 2023
Centro de Linguística da Universidade Nova de Lisboa UID/LIN/03213/2013, nível de proficiência INTERMÉDIO.

Scientific Activity

Mathematical modelling of soft matter, such as nematic liquid crystals and biological membranes, with particular reference to computational simulations.
Nematic liquid crystals.
Part of the research activity has dealt with the order reconstruction in nematic liquid crystal cells under the effect of a mechanical frustration or of an external field. A non-monotonic behaviour of the mediated forces

and torques in the cell has been described in model systems.
A mean field model for thermotropic biaxiality in nematic liquid crystals has been developed; several results have been obtained, as well as some interesting predictions on the phases that can be observed and their relative transitions.
Research activities in this field aim at assessing the role of steric interactions in the stability of ordered phases in nematic liquid crystals. In particular, focus is on developing analytical and numerical techniques to compute the excluded volume in rigid molecule models, and on a model that integrates polar electric interactions between molecules with purely steric potentials on the basis of such model, stable polar ferroelectric nematic phases have been predicted, even in the absence of an external field applied.

Biological Membranes: the analytic equilibrium solutions for lipid membranes has been studied, in detail in the two-dimensional case. The membrane-mediated interactions between protein inclusions have been analysed within a two dimensional model. Elaboration of a method to identify the symmetry of a mesophase by means of group projection.

Main/Recent conferences/workshops

- 6-13 April 2003 7th European Conference on Liquid Crystals 2003, Jaca (Spagna).
  Oral contribution: F. Bisi et al.: “Order Reconstruction in Frustrated Nematic Twist Cells”.
- 4-9 July 2004 20th International Liquid Crystal Conference 2004, Ljubljana (Slovenia).
  Oral contribution: F. Bisi et al.: “Mechanics of order reconstruction in nematic liquid crystals”.
  Posters: F. Bisi et al. “Order reconstruction vs. molecular reorientation in Freederiks transition”; F. Bisi et al.: “Interaction forces between point defects”.
- 27 February-4 March 2005 8th European Conference on Liquid Crystals Sesto (BZ) I.
  Oral contribution: F. Bisi et al.: “Order reconstruction and molecular reorientation in Freederiks transition”.
- 11-16 September 2005 Workshop on Soft Matter Mathematical Modelling (SMMM), Cortona (Italia).
  Oral contribution: F. Bisi: “Repertoire of biaxial nematic phases”.
- 2-7 July 2006 21st International Liquid Crystal Conference 2006, Keystone, CO (USA).
  Oral contribution: F. Bisi et al.: “Universal mean-field phase diagram for biaxial nematics”.
- 2-6 July 2007 9th European Conference on Liquid Crystals - Lisbon (P).
  Oral contribution: F. Bisi et al.: "Universal features in the nematic uniaxial-to-biaxial transition".
- 19-24 April 2009 10th European Conference on Liquid Crystals - Colmar (F).
  Oral contribution: F. Bisi, A.M. Sonnet, E.G. Virga: “Mean-field model for polar nematics”; Poster: F. Bisi et al.: “Excluded-volume short-range repulsive potential for tetrahedral molecules”; Poster: F. Bisi et al.: “Bifurcation analysis of a mean-field model for biaxial nematics”.
- 29-30 October 2009 Liquid Crystal Theory and Modelling Meeting, St Anne's College Oxford (UK)
  Oral contribution (invited speaker): F. Bisi: “Steric contributions to ordering potentials in nematic liquid crystals”.
- 22-23 April 2010: Workshop 'Modellizzazione matematica di materiali e processi' - Mantua (Italy) (Co-organiser)
  Oral contribution: F. Bisi: "Cristalli liquidi nematici: nuove frontiere per la modellizzazione di materiali nanostrutturati".
- 11-16 July 2010: 23rd International Liquid Crystal Conference - Krakow (PL).
  Oral contribution: F. Bisi et al.: “Steric effects in a mean-field model for polar nematic liquid crystals”; Poster: F. Bisi, G. Pająk, L. Longa, R. Rosso: “Steric contribution to short range repulsive potential for nonconvex nanoparticles”.
- 18-22 March 2013: Workshop 'Analytical and Computational Paths from Molecular Foundations to Continuum Descriptions', Isaac Newton Institute for Mathematical Sciences, Cambridge (UK).
- 22 March 2013: One Day BLCS/SMTG/INI Workshop on the Molecular Modelling and Theory of Liquid Crystals, Isaac Newton Institute for Mathematical Sciences, Cambridge (UK).
- 25-27 March 2013: BLCS Annual Meeting – Cambridge (UK)
  Oral contribution: F. Bisi et al.: “Calamitic and antinematic orientational order produced by the generalised Straley lattice model”; Poster: F. Bisi et al.: “Analytical computation of the steric tensor

for hard sphaerocylinders".

- 30 March - 1 April 2015: BLCS Annual Meeting – Sheffield (UK)
  Oral contribution: F. Bisi et al.: "Further tricritical and antinematic behaviour in a revisited mildly repulsive Straley model".
- 17-20 September 2018: 9th Italian-Japanese Workshop on Liquid Crystals and 13th National SICL Meeting - Pavia (Italy)
  Oral Contribution: "Determination of the symmetry classes of orientational ordering tensors"
- 26-28 May 2024: 15th National SICL Meeting - Sirolo (Italy)
  Oral Contribution: "Assessment of polar nematic phases through group projection".

Referral Activities:

Referee for Archive of Applied Mathematics, Beilstein Journal of Organic Chemistry, Crystals (also Member of Board), European Physical Journal E, International Journal of Modern Physics, Liquid Crystals, Macromolecules, Meccanica, NATURE, Physica D, Physical Review E, Proceedings of the Royal Society A, Results in Physics. Soft Matter.

Main Publications:

article	article
author	Turzi Stefano S., and Bisi Fulvio,
pages	37-57
title	Identification of low-symmetry phases in nematic liquid crystals
volume	684
note	Articolo in rivista
issn	1542-1406
journal	MOLECULAR CRYSTALS AND LIQUID CRYSTALS
doi	10.1080/15421406.2019.1581709
url	https://www.tandfonline.com/doi/abs/10.1080/15421406.2019.1581709?journalCode=gmcl20
year	2019
wosId	WOS:000487542300005
scopusId	2-s2.0-85073074746
abstract	Mesophases of nematic liquid crystals (NLC) are traditionally identified by building a second-rank ordering tensor S that efficiently describes the average orientation of nematogenic molecules with respect to a fixed laboratory/reference frame. In general, both in experiments and in simulations, the symmetry group of the molecules is known a-priori, contrary to the symmetry group of the phase; this latter has to be determined by analysing the numerical realisation of S, possibly affected by numerical errors. Furthermore, when a mesophase has a simple symmetric structure, as is the case of uniaxial nematics, the identification of the preferred direction is relatively an easy task. However, this task becomes less straightforward when the symmetry group of a mesophase is more complex. There is no generally accepted procedure to perform this analysis, but we have provided in a previous paper a new algorithm suited to identifying the symmetry group of the phase. We implement here such algorithm which gives a canonical representation of S for each of the classes that can be distinguished with a second-rank ordering tensor, and determines the nearest tensor of the assigned symmetry by group averaging.

article	article
author	Turzi Stefano, and BISI FULVIO,
pages	4277-4300
title	Determination of the symmetry classes of orientational ordering tensors
note	Articolo in rivista
issn	0951-7715
journal	NONLINEARITY
doi	10.1088/1361-6544/aa8713
url	http://iopscience.iop.org/article/10.1088/1361-6544/aa8713/pdf
year	2017
wosId	WOS:000414409300002
scopusId	2-s2.0-85036667033
abstract	The orientational order of nematic liquid crystals is traditionally studied by means of the second-rank ordering tensor S. When this is calculated through experiments or simulations, the symmetry group of the phase is not known a priori, but needs to be deduced from the numerical realisation of S, which is affected by numerical errors. There is no generally accepted procedure to perform this analysis. Here, we provide a new algorithm suited to identifying the symmetry group of the phase. As a by product, we prove that there are only five phase-symmetry classes of the second-rank ordering tensor and give a canonical representation of S for each class. The nearest tensor of the assigned symmetry is determined by group-projection. In order to test our procedure, we generate uniaxial and biaxial phases in a system of interacting particles, endowed with D_{\infty h} or D_{2h} symmetry, which mimic the outcome of Monte–Carlo simulations. The actual symmetry of the phases is correctly identified, along with the optimal choice of laboratory frame.
book	**book**
author	BISI FULVIO, and ROSSO RICCARDO,
pages	1-220
title	Introduzione alla Meccanica Teorica
note	Monografia o trattato scientifico
publisher	Edizioni La Dotta di Fontana S.
address	Casalecchio di Reno (BO) - ITA
isbn	9788898648344
url	http://www.edizioniladotta.com/wp/prodotto/introduzione-meccanica-teorica-f-bisi-r-rosso/
year	2014
abstract	Il libro nasce dall’esperienza didattica degli autori nell’insegnamento dei corsi di Fisica Matematica per la Facoltà di Ingegneria dell’Università degli studi di Pavia. Partendo da considerazioni geometriche elementari, viene proposto un percorso fondato sul formalismo vettoriale e tensoriale, volto a studiare le proprietà di inerzia, la cinematica, la statica e la dinamica di sistemi di punti materiali e di corpi rigidi, fino ad arrivare a introdurre i concetti di base della meccanica lagrangiana dei sistemi olonomi e i suoi risultati principali. Scopo principale del testo è quello di

	fornire un supporto didattico per l'apprendimento delle nozioni basilari della meccanica teorica. Ogni argomento viene presentato e motivato, con alcuni esempi ed applicazioni utili e significativi per la comprensione e l'apprendimento dello studente.
article	**article**
author	BISI FULVIO, and DE MATTEIS GIOVANNI, and ROMANO SILVANO,
pages	032502-1-032502-14
title	Calamitic and antinematic orientational order produced by the generalized Straley lattice model
volume	88
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.88.032502
url	http://pre.aps.org/pdf/PRE/v88/i3/e032502
year	2013
wosId	WOS:000324238800003
scopusId	2-s2.0-84885151980
abstract	We consider here a classical model, consisting of D2h-symmetric particles in a three-dimensional simple-cubic lattice; the pair potential is isotropic in orientation space, and restricted to nearest neighbors. The simplest potential model is written in terms of the squares of the scalar products between unit vectors describing the three interacting arms of the molecules, as proposed in previous literature. Two predominant antinematic couplings of equal strength (+1) are perturbed by a comparatively weaker calamitic one, parameterized by a coupling constant −z ranging in [−1,0]. This choice rules out thermodynamically stable phases endowed with macroscopic biaxiality. The antinematic terms favor states with the corresponding molecular axes mutually orthogonal. Although the low-temperature phase of the special case with null calamitic term (PP0) is uniaxial and antinematically ordered, in the general case presented here both Monte Carlo and molecular-field approaches show that, for z close to zero, the models exhibit a low-temperature uniaxial nematic phase, followed by an antinematic one, and finally by the orientationally disordered one. On the other hand, for sufficiently large values of z, we only find evidence of uniaxial calamitic behavior, as expected by following the limiting cases.
book	**book**
author	BRIVIO SONIA, and BISI FULVIO, and BONSANTE FRANCESCO,
pages	510
title	Lezioni di algebra lineare con applicazioni alla geometria analitica
note	Monografia o trattato scientifico
publisher	Edizioni La Dotta di Fontana S.
address	Casalecchio di Reno (BO) - ITA

isbn	9788898648023
doi	10.978.8898648/023
year	2013
abstract	Il libro nasce dall'esperienza didattica degli autori nell'insegnamento dei corsi di Geometria e Algebra per la Facoltà di Ingegneria dell'Università degli Studi di Pavia. Partendo da considerazioni geometriche elementari, viene proposto un percorso basato sull'algebra lineare con l'intento di mettere in relazione i concetti geometrici con la loro traduzione algebrica. Scopo principale del testo è quello di fornire un supporto didattico per l'apprendimento delle nozioni basilari dell'algebra lineare. Ogni argomento viene presentato e motivato con esempi ed applicazioni, seguiti da numerosi esercizi svolti, utili e significativi per la comprensione e l'apprendimento dello studente.
article	**article**
author	BISI FULVIO, and Giovanni De Matteis, and ROMANO SILVANO,
pages	020702(01)-020702(05)
title	Antinematic orientational order produced by an extreme case of the generalized Straley lattice model
volume	86
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.86.020702
url	http://pre.aps.org
year	2012
wosId	WOS:000307810500001
scopusId	2-s2.0-84865600391
abstract	We address here a special, extreme case of the quadratic pair interaction potential between classical, D2h-symmetric particles (the generalized Straley model) on a three-dimensional simple cubic lattice. The model involves predominant antinematic couplings and it has been studied by Monte Carlo simulation and a molecular field treatment. The obtained results show a second-order transition between the isotropic phase and the low-temperature one, exhibiting uniaxial antinematic order.
article	**article**
author	BISI FULVIO, and ROSSO RICCARDO,
pages	29-60
title	Excluded-volume potential for rigid molecules endowed with C_{2v} symmetry
volume	23
note	Articolo in rivista
issn	0956-7925
journal	EUROPEAN JOURNAL OF APPLIED MATHEMATICS

doi	10.1017/S0956792510000379
url	http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8458152&fulltextType=RA&fileId=S0956792510000379
year	2011
wosId	WOS:000299653000003
scopusId	2-s2.0-84155164507
abstract	The excluded volume of a pair of molecules is proportional to the second virial coefficient in hard-core models that represent, for instance, the reference model in perturbation approaches to statistical theories of fluids [see, e.g. Chap. 5 of Kalikmanov, V. (2001), Statistical Physics of Fluids. Texts and Monograph in Physics, Springer, Berlin]. In three space dimensions, there exist exact results for convex molecules and in fact lack of convexity has been a major obstacle in applying the mathematical techniques employed in the convex case. In this paper, we illustrate how a mixed—analytical and numerical—method can be used to obtain exact expressions of the excluded volume for a pair of non-convex molecules conceived as aggregates of hard spheres; these can model van der Waals regions associated to the atoms forming each molecule. To compute the excluded volume for molecules endowed with C2v symmetry, modelled as chains of tangent hard spheres, we adapt a numerical code available to the scientific community. Because the result is a rather cumbersome expression in term of the relative orientation of the interacting molecules, we expand it over a suitable set of symmetry adapted Wigner functions to build up approximate, but faithful expressions, and we also prove analytical results announced elsewhere [Bisi, F., Durand, G., Rosso, R. & Virga, E. (2008), Polar steric interactions for v-shaped molecules. Phys. Rev. E, 78, 011705].
article	**article**
author	BISI FULVIO, and Eugene C. Gartland, and VIRGA EPIFANIO GUIDO GIOVANNI,
pages	3-28
title	A criterion for symmetric tricritical points in condensed ordered phases
volume	23
note	Articolo in rivista
issn	0956-7925
journal	EUROPEAN JOURNAL OF APPLIED MATHEMATICS
doi	10.1017/S0956792510000355
url	http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=8458149&fulltextType=RA&fileId=S0956792510000355
year	2011
wosId	WOS:000299653000002
scopusId	2-s2.0-84055176401
abstract	Basic methods from bifurcation theory are applied to derive a criterion that predicts when a symmetric tricritical point may occur in a transition between condensed ordered phases described by any finite number of scalar order parameters. At such a point, a change of order takes place in the phase transition, which passes from first to second order, or vice versa.

article	article
author	BISI FULVIO,
pages	370-379
title	Steric Effects in Polar Nematic Liquid Crystals
volume	541
note	Articolo in rivista
issn	1542-1406
journal	MOLECULAR CRYSTALS AND LIQUID CRYSTALS
doi	10.1080/15421406.2011.570182
url	http://www.tandfonline.com/doi/abs/10.1080/15421406.2011.570182
year	2011
wosId	WOS:000299683700015
scopusId	2-s2.0-79960657936
abstract	Recent measurements in a nematic liquid crystal formed by polyester compounds have given evidence of spontaneous macroscopic polar ordering. A mean-field theory for liquid crystals is built combining short-range, repulsive, steric forces with the average electric dipolar energy exchanged between molecules sharing the same excluded region. Such model is capable of identifying both uniaxial and biaxial polar phases. Under the assumption of a spheroidal shape for the molecules, and through a numerical bifurcation analysis, we assess the stability of phases upon two interaction parameters: the degree of intrinsic biaxiality, and the relative orientation of the permanent electric dipoles.
article	**article**
author	BISI FULVIO, and SONNET A. M., and VIRGA EPIFANIO GUIDO GIOVANNI,
pages	041709-041709
title	Steric effects in a mean-field model for polar nematic liquid crystals
volume	82
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.82.041709
year	2010
wosId	WOS:000283124100008
scopusId	2-s2.0-78651275987
abstract	The existence of uniaxial liquid crystals comprising polar molecules, with all the dipoles aligned in a parallel pattern, is classically ruled out. Generally, there are two different avenues to a mean-field theory for liquid crystals: one is based on short-range, repulsive, steric forces, and the other is based on long-range, globally attractive, dispersion forces. Purely polar steric interactions have been shown to have the potential of inducing unexpected orientationally ordered states. In real molecules, anisotropies both in shape and in polarizability coexist; it has been

	shown that dispersion forces interaction can be combined with hard-core repulsion in a formal theory, based on a steric tensor. Starting from this, we build an interaction Hamiltonian featuring the average electric dipolar energy exchanged between molecules with the same excluded region. Under the assumption that the molecular shape is spheroidal, we propose a mean-field model for polar nematic liquid crystals which can exhibit both uniaxial and biaxial polar phases. By means of a numerical bifurcation analysis, we discuss the stability of the equilibrium against the choice of two model parameters, one describing the degree of molecular shape biaxiality and the other describing the relative orientation of the electric dipole within each molecule. We find only uniaxial stable phases, which are effectively characterized by a single scalar order parameter.
inproceedings	**inproceedings**
author	BISI FULVIO,
pages	29-40
title	Bifurcation Analysis of a Mean-Field Model for Biaxial Nematics
volume	525
note	Contributo in Atti di convegno
issn	1542-1406
booktitle	MOLECULAR CRYSTALS AND LIQUID CRYSTALS - 10th European Conference on Liquid Crystals (ECLC 2009)
journal	MOLECULAR CRYSTALS AND LIQUID CRYSTALS
doi	10.1080/15421401003795704
year	2010
month	2009
wosId	WOS:000286929300004
scopusId	2-s2.0-77954685386
abstract	The interest for macroscopic biaxiality has been recently revived by the experimental evidence of thermally driven transitions to biaxial phases, promoted by newly synthesized nematogenic molecules. In particular, the interaction model proposed by Straley for molecules endowed with D2h symmetry has been widely reconsidered. We elaborated a mean-field model based on a quadrupolar approximation to the mean torque potential has proven capable of capturing the universal features characterizing all phase diagrams compatible with the interaction model. Moreover, the phase sequences and the order of the transitions are weakly influenced by one of the interaction parameters. Here we show how to we derive the analytical bifurcation equations underlying our numerical analysis, and, subsequently, how these equations are instrumental to the correct resolution of the mean-field model. These bifurcation equations are integrated in a numerical code based on MATCONT, used for bifurcation analysis, which will be made available to the scientific community.
inproceedings	**inproceedings**
author	BISI FULVIO, and Longa Lech, and Pajak Grzegorz, and ROSSO RICCARDO,
pages	12-28

title	Excluded-volume short-range repulsive potential for tetrahedralmolecules
volume	525
note	Contributo in Atti di convegno
issn	1542-1406
journal	MOLECULAR CRYSTALS AND LIQUID CRYSTALS
year	2010
month	2009
scopusId	2-s2.0-77954686974
abstract	By adapting a numerical code available to the scientific community, we evaluate the analytical excluded volume function for non-convex tetrahedral molecules, modelled as chains of tangent hard spheres. Since this function is overly complicated, we expand it over a suitable set of Symmetry Adapted Wigner Functions (SAWFs)
article	**article**
author	AMBROZIC M., and BISI FULVIO, and VIRGA EPIFANIO GUIDO GIOVANNI,
pages	193-218
title	Director reorientation and order reconstruction: competing mechanisms in a nematic cell
volume	20
note	Articolo in rivista
issn	0935-1175
journal	CONTINUUM MECHANICS AND THERMODYNAMICS
doi	10.1007/s00161-008-0077-x
url	http://www.springerlink.com/content/f403658715uq73v7/
year	2008
wosId	WOS:000258601100001
scopusId	2-s2.0-50149122568
abstract	We propose a model to explore the competition between two mechanisms possibly at work in a nematic liquid crystal confined within a flat cell with strong uniaxial planar conditions on the bounding plates and subject to an external field. To obtain an electric field perpendicular to the plates, a voltage is imposed across the cell; no further assumption is made on the electric potential within the cell, which is therefore calculated together with the nematic texture. The Landau-de Gennes theory of liquid crystals is used to derive the equilibrium nematic order tensor Q. When the voltage applied is low enough, the equilibrium texture is nearly homogeneous. Above a critical voltage, there exist two different possibilities for adjusting the order tensor to the applied field within the cell: plain director reorientation, i.e., the classical Freedericksz transition, and order reconstruction. The former mechanism entails the rotation of the eigenvectors of Q and can be described essentially by the orientation of the ordinary uniaxial nematic director, whilst the latter mechanism implies a significant variation of the eigenvalues of Q within the cell, virtually without any rotation of its eigenvectors, but with the intervention of a wealth of biaxial states. Either mechanism can actually occur,

	which yields different nematic textures, depending on material parameters, temperature, cell thickness and the applied potential. The equilibrium phase diagram illustrating the prevailing mechanism is constructed for a significant set of parameters.
article	**article**
author	BISI FULVIO, and LUCKHURST G. R., and VIRGA EPIFANIO GUIDO GIOVANNI,
pages	021710-1-021710-6
title	Dominant biaxial quadrupolar contribution to the nematic potential of mean torque
volume	78
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.78.021710
url	http://link.aps.org/doi/10.1103/PhysRevE.78.021710
year	2008
wosId	WOS:000259263600085
scopusId	2-s2.0-50849134627
abstract	Within the general quadrupolar model for biaxial nematic liquid crystals, whose potential of mean torque extends that in the Maier-Saupe theory with two extra interaction terms, we propose a quantitative criterion to identify the dominant biaxial interaction. We show that the ratio of the biaxial-to-uniaxial and uniaxial-toisotropic transition temperatures is almost independent of one interaction parameter, thus indicating the other as dominant. We also show that there is a significant mismatch between the principal orientational order parameters predicted by the theory and those measured for the biaxial phase of a tetrapode.
article	**article**
author	BISI FULVIO, and ROSSO RICCARDO, and VIRGA EPIFANIO GUIDO GIOVANNI, and DURAND G. E.,
pages	011705-1-011705-8
title	Polar steric interactions for V-shaped molecules
volume	78
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.78.011705
year	2008
wosId	WOS:000258178600065
scopusId	2-s2.0-48349131076
abstract	We consider the effect of shape polarity in the excluded-volume interaction between

	V-shaped polar particles in orientationally ordered phases. We show that the polar component of the steric interaction between these polar particles, large enough in two space dimensions, can also become important in three space dimensions. Unexpectedly, polar steric interactions, up to now neglected, favor an "antiparallel" pair binding, which may be the building block of orientationally ordered phases for polar particles. An antiferromorphic smectic ordering, which is also antiferroelectric, could further be attained at high enough density by the same mechanism.
article	**article**
author	BISI FULVIO,
pages	182-201
title	Universal mean-field phase diagram for biaxial nematics
volume	480
note	Articolo in rivista
issn	1542-1406
journal	MOLECULAR CRYSTALS AND LIQUID CRYSTALS
doi	10.1080/15421400701826316
url	http://www.informaworld.com/smpp/content~content=a790749504~db=all~order=page
year	2008
wosId	WOS:000253457500018
scopusId	2-s2.0-39649102918
abstract	Fully attractive and partly repulsive molecular interactions, characteristic of biaxial liquid crystal molecules, are described by a class of quadratic Hamiltonians, originally put forward by Straley. The partly repulsive interactions require a minimax principle for the associated mean-field free energy. By analyzing the different phases in a bifurcation scenario, we show that the phase diagram described by Sonnet et al. [Phys. Rev. E 67 061701 (2003)] is universal. Our model predictions are in agreement with recent observations on both V-shaped and tetrapodal molecules.
article	**article**
author	BISI FULVIO,
pages	112-132
title	Universal features in the nematic uniaxial-to-biaxial transition
volume	495
note	Articolo in rivista
issn	1542-1406
journal	MOLECULAR CRYSTALS AND LIQUID CRYSTALS
doi	10.1080/15421400802430547
url	http://www.informaworld.com/smpp/title~content=g906638079~db=all
year	2008
wosId	WOS:000262857600008

scopusId	2-s2.0-57649200353
abstract	Recent experimental findings about new nematogenic molecules have reported thermally driven transitions to biaxial phases, which has revived the interest for macroscopic biaxiality. In particular, the simplified interaction model proposed by Straley for molecules endowed with D_2h symmetry has met renewed interest. In the scenario obtained for phases a unifying character can be captured. There exists a universal feature in the behaviour of one uniaxial order parameter, rebounding at the biaxial-to-uniaxial transition. This finding has been confirmed by means of a Monte-Carlo simulation. Moreover, the phase sequences and the order of the transitions are poorly influenced by one of the interaction parameters.
article	**article**
author	BISI FULVIO, and ROMANO SILVANO, and VIRGA EPIFANIO GUIDO GIOVANNI,
pages	041705
title	Uniaxial rebound at the nematic biaxial transition
volume	75
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.75.041705
url	http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PLEEE8000075000004041705000001&idtype=cvips&gifs=yes
year	2007
wosId	WOS:000246073900069
scopusId	2-s2.0-34247508077
abstract	Over the last few years, renewed interest has been raised by the simplified general interaction models proposed by Straley for mesogenic molecules possessing the D_2h symmetry and capable of producing biaxial nematic order. It has already been shown that, in the presence of certain special symmetries, just two out of the four order parameters that are in general necessary, suffice for the description of a biaxial phase. For some other range of parameters, these reducing symmetries do not hold, and, moreover, a mean-field treatment has to be suitably changed into a minimax strategy, still producing a transition to a low-temperature biaxial phase. Upon studying the general parameter range, we identify as a common feature the behavior of a uniaxial order parameter, attaining a local minimum at the biaxial-to-uniaxial transition temperature, and recognizably increasing away from it. This finding is confirmed by a Monte Carlo simulation.
article	**article**
author	DE MATTEIS GIOVANNI, and BISI FULVIO, and VIRGA EPIFANIO GUIDO GIOVANNI,
pages	1-23
title	Constrained stability for biaxial nematic phases
volume	19

note	Articolo in rivista
issn	0935-1175
journal	CONTINUUM MECHANICS AND THERMODYNAMICS
doi	10.1007/s00161-007-0041-1
url	http://www.springerlink.com/content/3961752265838884/?p=ad16515c877342d7a9d4ffb99fdba15d&pi=0
year	2007
wosId	WOS:000247238300001
scopusId	2-s2.0-34250308941
abstract	We study the invariance properties of the molecular Hamiltonian interaction put forward by Straley to describe biaxial nematic phases. We show that the reduction to two out of four scalar order parameters, which was accidently remarked upon in the literature, is indeed a rigorous consequence of the Hamiltonian invariance for specific values of the interaction parameters. The stability analysis of the mean-field free energy in the reduction classes for the order parameters reveals a sequence of Landau triple points.
article	**article**
author	BISI FULVIO, and VIRGA EPIFANIO GUIDO GIOVANNI, and E. C. GARTLAND JR, and DE MATTEIS GIOVANNI, and A. M. SONNET, and G. E. DURAND,
pages	051709
title	Universal mean-field phase diagram for biaxial nematics obtained from a minimax principle
volume	73
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.73.051709
url	http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PLEEE8000073000005051709000001&idtype=cvips&gifs=yes
year	2006
wosId	WOS:000237951300051
scopusId	2-s2.0-33646800550
abstract	We study a class of quadratic Hamiltonians which describe both fully attractive and partly repulsive molecular interactions, characteristic of biaxial liquid crystal molecules. To treat the partly repulsive interactions we establish a minimax principle for the associated mean-field free energy. We show that the phase diagram described by Sonnet et al. [Phys. Rev. E 67, 061701 (2003)] is universal. Our predictions are in good agreement with the recent observations on both V-shaped and tetrapodal molecules.
inbook	**inbook**
author	BISI FULVIO, and VIRGA EPIFANIO GUIDO GIOVANNI,

pages	111-132
title	Surface order forces in nematic liquid crystals
volume	141
note	Contributo in volume (Capitolo o Saggio)
publisher	Springer Science+Business Media, Inc.
address	New York - USA
isbn	9780387291673
booktitle	IMA Volumes in Mathematics and its Applications 141
doi	10.1007/0-387-32153-5_5
url	http://www.springerlink.com/content/978-0-387-29167-3
year	2005
wosId	000235134300005
abstract	The notion of surface order force in nematic liquid crystals is presented and contrasted with the notions of similar forces already introduced in the literature. We illustrate how a surface order force could in principle be measured and how it would convey the mechanical signature of an intrinsically nanoscopic phenomenon, often referred to as order reconstruction. The relationship between this force and the occurrence of biaxial states of the nematic order tensor is further illuminated.
article	**article**
author	BISI FULVIO, and VIRGA EPIFANIO GUIDO GIOVANNI, and DURAND G. E.,
pages	042701-1-042701-4
title	Nanomechanics of order reconstruction in nematic liquid crystals
volume	70
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.70.042701
url	http://scitation.aip.org/getabs/servlet/GetabsServlet?prog=normal&id=PLEEE8000070000004042701000001&idtype=cvips&gifs=yes
year	2004
wosId	WOS:000225689500058
scopusId	2-s2.0-41349087754
abstract	We employ a continuum model to compute both torque and force transmitted through a thin twist cell filled with a nematic liquid crystal and bounded by flat plates with anchorings at right angles. The transmitted torque vanishes at the order reconstruction threshold when the cell thickness is comparable with the biaxial coherence length. At the same point, the force diagram exhibits an angular point which disappears above a critical twist mismatch. Both torque and force diagrams against the cell's thickness fail to be monotonic when the total twist is near pi/2.
article	**article**

author	BISI FULVIO, and E. C. GARTLAND, and ROSSO RICCARDO, and VIRGA EPIFANIO GUIDO GIOVANNI,
pages	021707-1-021707-11
title	Order reconstruction in frustrated nematic twist cells
volume	68
note	Articolo in rivista
issn	1539-3755
journal	PHYSICAL REVIEW E, STATISTICAL, NONLINEAR, AND SOFT MATTER PHYSICS
doi	10.1103/PhysRevE.68.021707
url	http://prola.aps.org/abstract/PRE/v68/i2/e021707
year	2003
wosId	WOS:000185193900056
scopusId	2-s2.0-37649026728
abstract	Within the Landau-de Gennes theory of liquid crystals, we study the equilibrium configurations of a nematic cell with twist boundary conditions. Under the assumption that the order tensor Q be uniaxial on both bounding plates, we find three separate classes of solutions, one of which contains the absolute energy minimizer, a twistlike solution that exists for all values of the distance d between the plates. The solutions in the remaining two classes exist only if d exceeds a critical value d(c). One class consists of metastable, twistlike solutions, while the other consists of unstable, exchangelike solutions, where the eigenvalues of Q are exchanged across the cell. When d=d(c), the metastable solution relaxes back to the absolute energy minimizer, undergoing an order reconstruction somewhere within the cell. The critical distance d(c) equals, in general, a few biaxial coherence lengths. This scenario applies to all the values of the boundary twist but pi/2, which thus appears as a very special case, though it is the one more studied in the literature. In fact, when the directors prescribed on the two plates are at right angles, two symmetric twistlike solutions merge continuously into an exchangelike solution at the critical value of d where the latter becomes unstable. Our analysis shows how the classical bifurcation associated with this phenomenon is unfolded by perturbing the boundary conditions.
article	**article**
author	BISCARI P, and BISI FULVIO, and ROSSO RICCARDO,
pages	37-56
title	Curvature effects on membrane-mediated interactions of inclusions
note	Articolo in rivista
issn	0303-6812
journal	JOURNAL OF MATHEMATICAL BIOLOGY
year	2002
scopusId	2-s2.0-0036632553
article	**article**
author	BISCARI P, and BISI FULVIO,

pages	381-386
title	Membrane-mediated interactions of rod-like inclusions
volume	7
note	Articolo in rivista
issn	1292-8941
journal	THE EUROPEAN PHYSICAL JOURNAL. E, SOFT MATTER
doi	10.1140/epje/i2001-10103-x
url	http://epje.edpsciences.org/index.php?option=article&access=standard&Itemid=129&url=/articles/epje/abs/2002/04/epje01158/epje01158.html
year	2002
wosId	WOS:000177005000009
scopusId	2-s2.0-0036557253
abstract	Inclusions embedded in lipid membranes undergo a mediated force. due to the tendency of the membrane to relax its excess of elastic energy. In this paper we determine the exact shape of a two-dimensional vesicle hosting two different inclusions. and we analyse how the inclusion conformation influences the mediated interaction. We find non-trivial equilibrium configurations for the inclusions along the hosting membrane, and we derive the complete phase diagram of the mediated interaction. In particular, we find a non-vanishing mediated force even when the distance between the inclusions is much greater than their size. Our model can be applied to describe the mediated interactions of parallel, elongated inclusions embedded in three-dimensional membranes.
article	**article**
author	BISI FULVIO, and GHETTI F, and GIOFFR D, and LENCI F, and TARONI P.,
pages	185
title	Time-resolved spectroscopy of photo-oxidized blepharismin
volume	22
note	Articolo in rivista
issn	0302-0800
journal	MÉDECINE. BIOLOGIE. ENVIRONNEMENT
year	1994
article	**article**
author	SCEVOLI P, and BISI FULVIO, and COLOMBETTI G, and GHETTI F, and LENCI F, and PASSARELLI V.,
pages	74-84
title	Photomotile responses of Blepharisma Japonicum I: action spectra determination and time-resolved fluorescence of photoreceptor pigments
volume	1
note	Articolo in rivista
issn	1011-1344

journal	JOURNAL OF PHOTOCHEMISTRY AND PHOTOBIOLOGY B-BIOLOGY
doi	10.1016/1011-1344(87)80007-6
url	http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TH0-44F78WC-1D&_user=3719172&_coverDate=09%2F30%2F1987&_alid=923188350&_rdoc=1&_fmt=high&_orig=search&_cdi=5268&_sort=d&_docanchor=&view=c&_ct=1&_acct=C000061210&_version=1&_urlVersion=0&_userid=3719172&md5=4b17d3749c90156c5d986697b6759fd0
year	1987
wosId	WOS:A1987K162800006
scopusId	2-s2.0-0002898082
abstract	The light-induced avoiding reaction of Blepharisma Japonicum was investigated by means of microscope videorecording techniques. The percentage of photoreacting cells and the lag time between stimulus onset and reaction were measured as a function of the fluence rate and of the light stimulus wavelength. Action spectra indicate that the red pigment blepharismin is the photoreceptor pigment for this photoresponse. The fluorescence lifetimes and quantum yields of ethanol-extracted pigments and cold-extruded pigment granules were measured by means of a phase-modulation spectrofluorometer. The fluorescence lifetime and quantum yield of the pigment in granules are half those of pigments in ethanol solution. This could be in agreement with the hypothesis that blepharismin is the photoreceptor pigment for the observed photobehaviour.