

Dr. Elena Buixaderas, PhD.

born 09.08.1969, Spain, Spanish citizenship, two children

Education and work experience

1993: Bachelor of Sciences (specialization in Optical Physics and Astrophysics) from the University of Zaragoza, Spain

2001: Ph Doctor in Physics, Basque University, SPAIN (Thesis on Spectroscopic investigation of lattice dynamics and its disorder in ferroelectric and related materials)

2001 - 2002: Junior researcher in the Department of Dielectrics, Institute of Physics, Academy of Sciences of the Czech Republic, Prague

2002 - 2003: Post-doc researcher in CNRS-CNRHT, Orleans, France

2005-2022: Senior researcher in the Department of Dielectrics, Institute of Physics, Czech Academy of Sciences, Prague.

Since 2022: Head of the Raman and light scattering group.

Two maternity breaks in 2001 and 2005

Awards:

2005 Otto Wichterle Prize of the Academy of Sciences of the Czech Republic

Fellowships:

- 2002 (15 months) Postdoctoral position *Le Studium* in CNRS-CNRHT Orleans France (Raman spectroscopy at very high temperatures)
- 1997-2001 (4 years) Scholarship from the Department of Researching of the Government of the Basque Country, Spain, for doctoral studies in the Institute of Physics in Prague, Czech Republic.
- 1996 (12 months) Scholarship from the Foreign Department of Spain to study in the Institute of Physics in Prague, Czech Republic.

Research areas:

Raman scattering, Fourier-transform infrared spectroscopy, time-domain THz spectroscopy, phase transitions, phonons, lattice dynamics, ferroelectrics, multiferroics, relaxors, composites, phase change materials, biocompatible materials.

Miscellanea:

Author and co-author of 70 scientific publications in refereed journals (including 3 review papers, one chapter in a monograph) with about 1300 citations, h-index 18.

Board Member of the Structural And Dynamical Properties Of Solids section in Condense Matter division of EPS.

More than 100 participations in international conferences and workshops, including 20 invited talks.

Current reviewer for IOP, AIP, Elsevier, Springer journals.

Evaluator of scientific EU projects.

Mentor of numerous students at the Institute of Physics, with regular participation in outreach and soft skills programs

Projects as PI:

- 2021-2023: High-frequency dielectric response of uniaxial relaxor and other multiferroic materials (mobility project LAS-21-02). Bilateral grant Czech-Lithuanian Academies of Sciences.
- 2017-2019: Structure-thermal properties correlation of composite materials for energy applications (mobility project AR-17-02). Bilateral grant Czech-Rumanian Academies of Sciences.
- 2016-2018: Lattice dynamics and dielectric response of tetragonal tungsten-bronze oxides (Number: 16-09142S). Czech Science Foundation.
- 2015-2017: Piezoelectric and multiferroics for future electronics (Number LD 15014, VES15 COST CZ). Ministry of Education, Youth and Sports in the Czech Republic

Scientific activity in the last 5 years

I was studying the lattice dynamics and phonon behaviour of uniaxial relaxor ferroelectrics (mainly the $(\text{Sr},\text{Ba})_5\text{Nb}_2\text{O}_6$ and $(\text{Ca},\text{Ba})_5\text{Nb}_2\text{O}_6$ solid solutions). Apart from IR and Raman spectroscopy I performed also Brillouin scattering experiments and analysis of diffuse scattering, as well as simulations in these crystals, which were never performed up to know due to the big size of the unit cell and limitations of the calculations. With my team I discovered that the complex dielectric response is due to the interplay of several excitations with different length scales and different frequencies, starting from mHz up to the THz range. Our pioneering simulations showed that modulations in SBN crystals are related to the disordered position of some cations and distortion of the oxygen octahedra network. We also discovered that SBN has two sublattices related to the two different position and octahedra in the crystal lattice and this seems to be primordial in shaping the dielectric behaviour of these materials. I published two review papers and a chapter book about this family of materials.

I am also studying lead based antiferroelectrics: PZT ceramics with 2 to 10% of Ti and PbZrO_3 single crystals (pure and with small amount of Ti) to understand the coexistence of the ferroelectric and antiferroelectric states. I am using Raman, IR and THz spectroscopies to study the phonon behaviour and its influence on the dielectric properties, in different types of samples: ceramics, films and single crystals. I am also studying other antiferroelectric crystals containing Hf and Sn, to investigate the nature of the metastable intermediate phases and coexistence of discommensurations and antiferroelectricity.

Recently I was involved in the study of the genesis of ferroelectricity in the famous incipient ferroelectric KTaO_3 when substituted with Li atoms. I successfully found –thanks to Raman spectroscopy, in an innovative angular dependence experiment at cryogenic temperatures– the percolative nature of the transition and the preferential arrangement of the ferroelectric clusters.

I was also involved in the implementation of the osseointegration of bone implants using ferroelectric coatings, (mainly BaTiO_3 films on Ti and Ti/Nb substrates, and in the investigation of ceramic-glass phase change composite materials for green energy applications in buildings. Lately I took part, as well, in the investigation of new materials perspective for exotic topologies, for instance CsNO_3 and $\text{Bi}(\text{Ge},\text{Si})\text{O}_4$.

Selected publications

- Chapter book: Phonons and relaxations in tetragonal tungsten bronzes, E. Buixaderas and J. Dec, in *Perovskites and Other Framework Structure Materials: New Trends and Perspectives*, edited by M. B. Smirnov and P. Saint-Grégoire, (Collaborating Academics IP, France, 2021).
- Review: Dynamics of mesoscopic polarization in uniaxial tetragonal tungsten-bronze $(\text{Sr}_x\text{Ba}_{1-x})\text{Nb}_2\text{O}_6$, E. Buixaderas, M. Kempa, Š. Svirskas et al., *Phys. Rev. B* 100, 184113 (2019).
- Review: Lattice dynamics and dielectric relaxational processes in some ferroelectrics and related materials, E. Buixaderas, S. Kamba and J. Petzelt, *Ferroelectrics* 308, 131-192 (2004).
- Fast polarization mechanisms in the uniaxial tungsten-bronze relaxor strontium barium niobate SBN-81, E. Buixaderas, C. Kadlec, M. Kempa et al., *Scientific Reports* 7, 18034 (2017).
- Lattice dynamics and domain wall oscillations in morphotropic PZT ceramics, E. Buixaderas, V. Bovtun, M. Kempa, D. Nuzhnyy, M. Savinov, P. Vanek, I. Gregora and B. Malic, *Phys. Rev. B* 94, 054315 (2016).
- Multiple soft-mode vibrations of PbZrO_3 , J. Hlinka, T. Ostapchuk, E. Buixaderas et al., *Phys Rev. Lett.* 112, 197601 (2014).
- Polar lattice vibrations and phase transition dynamics in $\text{Pb}(\text{Zr}_{1-x}\text{Ti}_x)\text{O}_3$, E. Buixaderas, D. Nuzhnyy, J. Petzelt, et al. *Phys. Rev. B* 84, 184302 (2011).
- Raman spectroscopy and effective medium approximation in PLZT x/40/60, E. Buixaderas, I. Gregora, S. Kamba, J. Petzelt, *J. Phys.: Condens. Matt.* 20, 345229 (2008).
- Infrared and dielectric spectroscopy of the relaxor ferroelectric $\text{Sr}_{0.6}\text{Ba}_{0.39}\text{Nb}_2\text{O}_6$, E. Buixaderas, M. Savinov, M. Kempa, et al., *J. Phys. Condens. Mat.* 17, 653 (2005).