

**Zeitschrift:** Helvetica Physica Acta  
**Band:** 62 (1989)  
**Heft:** 6-7

**Artikel:** Off-axis configuration of F<sub>A</sub>(Li) centres in KF  
**Autor:** Scacco, A. / Somma, F. / Rossi, M.  
**DOI:** <https://doi.org/10.5169/seals-116077>

### **Nutzungsbedingungen**

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

### **Conditions d'utilisation**

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

### **Terms of use**

The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

**Download PDF:** 23.02.2026

**ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>**

**OFF-AXIS CONFIGURATION OF  $F_A(\text{Li})$  CENTRES IN KF**

A. Scacco, F. Somma, M. Rossi, F. De Matteis, Dipartimento di Fisica, Università *La Sapienza*, P.le A. Moro 2, 00185 Roma, Italy

G. Baldacchini, ENEA, Dip.TIB, U.S. Fisica Applicata, CRE Frascati, C.P.65, 00044 Frascati, Italy

U.M. Grassano, Dipartimento di Fisica, Università di Roma-Tor Vergata, V. O. Raimondo, 00173 Roma, Italy

**Abstract:** The off-axis configuration of  $F_A$  dipoles was identified in  $\text{KF}:\text{Li}^+$ . The centre tilt from the crystal axis is, as expected, larger in  $\text{KF}:\text{Li}^+$  than in  $\text{KCl}:\text{Li}^+$  and in  $\text{RbCl}:\text{Li}^+$ .

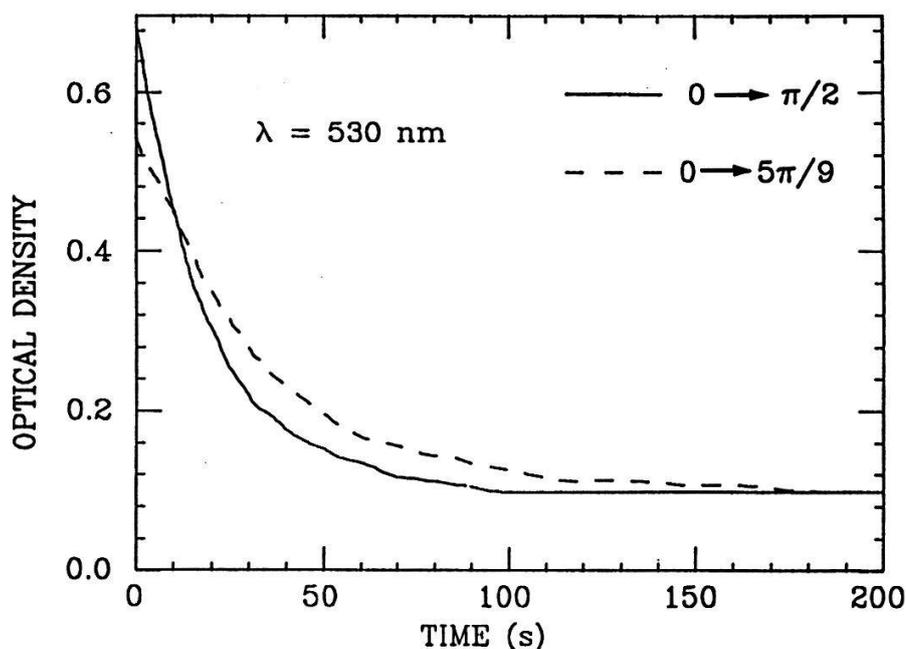
### 1. Introduction

The off-centre displacement of  $\text{Li}^+$  ions in crystals of alkali halides, showing a sufficiently large lattice parameter, was experimentally observed in  $\text{KCl}$  [1] and in  $\text{RbCl}$  [2], and theoretically calculated for several systems [3]. Such a peculiar configuration of the isolated impurity seems to be correlated in the above systems to a tilt from the crystal axis of the  $F_A$  dipole, formed by association of the impurity ion with a nearest-neighbour anion vacancy trapping an electron. The off-axis deviation of the  $F_A(\text{Li})$  centres was quantitatively determined both in  $\text{KCl}:\text{Li}^+$  [4] and  $\text{RbCl}:\text{Li}^+$  [5] by means of optical measurements. In this work the investigation on the configuration of  $F_A(\text{Li})$  dipoles is extended to  $\text{KF}:\text{Li}^+$ .

### 2. Experimental results and discussion

The technique used for studying the off-axis geometry of the  $F_A(\text{Li})$  centres is the analysis of their photostimulated reorientation under polarized optical pumping into the range of the  $F_A$  absorption [6]. The alignment process was theoretically treated, by taking into account both the off-axis effect of the dipoles and the overlap of the two  $F_A$  absorption bands, for experiments in equilibrium conditions [4] or during transient phenomena [7].

In  $\text{KF}:\text{Li}^+$  preliminary absorption measurements have been performed on transient effects. After thorough orientation of the centres by irradiation with monochromatic  $F_A$  light polarized along one of the crystal axes, the polarization plane of the incident beam was suddenly rotated: as a consequence, a depopulation occurs for centres lying parallel to the above direction, while the centre population along perpendicular directions increases correspondingly. The initial absorption  $\alpha(0)$  and the steady-state absorption  $\alpha(\infty)$ , measured for two different rotations of the polarization plane of the exciting light (Figure 1),



**Figure 1:** Kinetics of the  $F_A(\text{Li})$  centre photostimulated reorientation in  $\text{KF}:\text{Li}^+$  at 77 K.

allow the calculation of both the off-axis angle  $\theta$  of the  $F_A$  dipoles and the ratio  $R$  of the cross sections related to the two  $F_A$  transitions.

From these and other results, obtained at various wavelengths of the pumping light, it is possible to deduce a first approximate evaluation of  $\theta$  in  $\text{KF}:\text{Li}^+$ , which is slightly bigger than  $10^\circ$ . Such value, to be confirmed by luminescence experiments at various temperatures, is larger than those in  $\text{KCl}:\text{Li}^+$  and in  $\text{RbCl}:\text{Li}^+$ , as expected because of the more pronounced displacement of the isolated  $\text{Li}^+$  ion in this system [3].

### 3, References

- [1] F. Rosenberger and F. Lüty, *Solid State Commun.* **7**, 983 (1969).
- [2] K. Thörmer and F. Lüty, *Phys. Status Solidi (b)* **90**, 277 (1978).
- [3] C.R.A. Catlow, K.M. Diller, N.J. Norgett, J. Corish, B.M.C. Parker, and P.W.M. Jacobs, *Phys. Rev. B* **18**, 2739 (1978).
- [4] G. Baldacchini, K. Somaiah, U.M. Grassano, A. Scacco, and F. Somma, *Il Nuovo Cimento* **9D**, 1105 (1987).
- [5] G. Baldacchini, F. De Matteis, E. Giovenale, A. Scacco, F. Somma, and U.M. Grassano, *Phys. Rev. B* **37**, 7014 (1988).
- [6] F. Lüty, in *Physics of Color Centers*, ed. W.B. Fowler (Academic, New York, 1968), Chap. 3.
- [7] G. Baldacchini, U.M. Grassano, A. Scacco, and F. Somma, *Phys. Scripta* **37**, 381 (1988).