

## In Memoriam

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# Memories to Stanisław Kielich: My teacher, my mentor and my friend

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### 1. Kielich's style

There is no doubt that Kielich wrote his papers in his own elegant and specific style. He invented and introduced a special formalism suitable for molecular and nonlinear physics based on Cartesian tensors in which he made use of his deep knowledge of achievements of the old masters of molecular physics. In his scientific work he has shown his great involvement in molecular physics. In the peak of his carrier he wrote his papers fast and efficiently. In the nineteen sixties after construction of the laser, a lot of new optical (linear and nonlinear) effects were discovered. Several of them Kielich had already on his mind. His colleges remember that at a few occasions on the day following their discussions of a new physical effect Kielich would come to the Institute with his paper on the subject almost ready for publication. He mastered tensor calculus, so nonlinear optics was the area he admired. He learned tensor calculus while working with Piekara [1] and then he extended this formalism. From the early years of his scientific carrier he strongly admired works of Buckingham [2,3]. He liked to generalize every problem he worked on.

### 2. Light scattering

Kielich was especially interested in the theory of light scattering (linear and nonlinear). One of his first single-handed papers was devoted to the light scattering problems [4–7]. Moreover, from the beginning of his research work he was strongly involved in several subjects of nonlinear optics [8]. It is interesting to note that the laser had yet not been constructed at this time! Invention of the laser was a great stimulation in the area of nonlinear physics research. Already in 1961 Kielich wrote a paper on the nonlinear light scattering [9]. Several works followed this study [10–17]. Kielich is recognized [10,12] for having predicted for the first time the phenomenon of the hyper-Rayleigh scattering of intense laser

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Fig. 1. Professor Kielich with Professor Bloembergen in Fontevrault.



Fig. 2. Professor Kielich with Professor Davies working in Poznań.

light. Parallel studies were performed by Li [18] and Cyvin, Rauch and Decius [19]. This effect was experimentally detected for the first time in 1965 by Terhune, Maker and Savage [20].

Studying light scattering process Kielich paid special attention to the role of intermolecular interactions in nonlinear phenomena [17,21–23]. He studied intermolecular interactions in his very elegant and efficient statistical-molecular tensor based style [24]. In 1968 the monomer forbidden Rayleigh collision-induced light scattering was detected [25,26]. It was shown that an interacting pair of spherical molecules (atoms) possesses an excess anisotropic collision-induced polarizability and this excess polarizability leads to monomer forbidden depolarized light scattering. Kielich was strongly convinced that similar process exists also in the case of the hyper-Rayleigh (and hyper-Raman) light scattering. He shown that colliding pair of (even) centrosymmetric molecules has configurations with no center of inversion and the created fly-by supermolecule is a source of the second harmonic light scattering. This kind of scattering was detected by Kielich, Lalanne and Martin [27] during Kielich's sabbatical (1971–1972) year at the Bordeaux University.

### 3. Other subjects

Kielich has also been involved in many other scientific subjects. The number of subjects he studied is impressive. He started his scientific carrier studying statistical molecular theories of electric, magnetic, and optical saturation (with A. Piekara). Then he investigated intermolecular multipolar interactions in electro-optical and magneto-optical phenomena including optical activity. He considered linear and nonlinear spectroscopy of macromolecular and colloidal systems. He introduced to this field special functions now named Langevin-Kielich functions. Kielich contributed also to quantum optics. He studied photon anti-bunching and squeezed states of the electromagnetic field. All Kielich's papers are available in the pdf format on the web page <http://zon8.physd.amu.edu.pl> in the section: history.

Institutions and laboratories have a history which influence their future. Some scientists contribute strongly to this history. Stanisław Kielich was one of those.

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