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## Light interacting with the vacuum

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OPTICA Vice-President Keynote Talk

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Abstract:

We treat the virtual particle-anti-particle pairs in the vacuum as two level quantum systems with a transition energy of  $2mc^2$ , forming a dielectric and a diamagnetic. The approach describes the linear response explaining the parameters appearing in Maxwell's equations and also the nonlinear response. This phenomenological model is largely compatible with quantum field theory, without leading to divergencies. The approach provides novel insight into the ubiquitous vacuum medium.

Short Bio:

Gerd Leuchs studied physics at the Universities of Cologne and Munich. His PhD-thesis dealt with the fine structure splitting of sodium Rydberg atoms. He received the Habilitation degree at the University of Munich on multiphoton processes in atoms. After stays in the USA and Switzerland, Gerd Leuchs became full professor of physics at the University Erlangen-Nuremberg in Germany. Since 2009 he was director at the Max Planck Institute for the Science of Light and since 2011 he is professor adjunct at the University of Ottawa. He is member of the German and of the Russian Academy of Sciences and holds honorary degrees from Danish Technical University and St. Petersburg State University. He won the 2005 Quantum Electronics and Optics Prize of the European Physical Society and the 2018 Herbert Walther Prize, a joint award by Optica (formerly OSA) and DPG. In 2012 he was awarded the Cross of Merit of the Federal Republic of Germany and in 2018 he was appointed a member of Bavaria's Maximilian Order. Currently (2022) he is vice-president of Optica. His research spans the whole range from classical to quantum optics, with emphasis on the limits of focussing, on photon-atom-coupling and on quantum noise reduction of light.

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