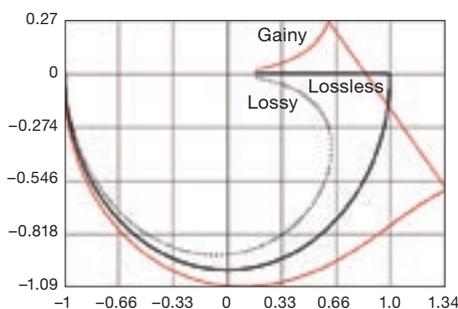


### On Fresnel Reflection and Evanescent Gain

OPN recently published an article by A.E. Siegman, titled “Fresnel Reflection, Lensef Reflection and Evanescent Gain” (January 2010). We argue that many of the claims in the article are incorrect.

For example, the article states that: “Satisfying the boundary conditions for the  $E$  and  $H$  fields at the interface provides a recipe for finding  $k_2$  as a function of the incident  $k_1$ .” Actually,  $k_2$  as a function of the incident  $k_1$  does not depend on the boundary conditions for the fields. The article goes on to state that the, “imaginary part corresponds to absorption loss if  $n_{2i}$  is negative, and to gain if  $n_{2i}$  is positive.” In fact, the correct signs are opposite.

Siegman also states, “... $k_{2x}$  taking on the same positive sign for equal values of either loss or gain.” We argue that signs of  $k_{2x}$  are opposite in lossy and gainy cases. In addition, according to



the article, “ $g_{2x}$  takes on positive and negative signs for the gainy and lossy cases, respectively.” However, in the TIR regime,  $g_{2x}$  has the same negative sign for both the gainy and lossy cases.

We also take issue with the following point: “The contours for the lossy and gainy amplitudes ... progress in opposite directions around the unit circle.” No, actually, they progress in the same clockwise direction. In addition, Siegman states: “The magnitude of the reflection coefficient always remains less

than unity for any angle of incidence and for any value of loss or gain.” But in fact the TIR reflection coefficient for the gainy case is larger than unity. We propose that our figure, included here, reflects the correct situation.

Finally, according to the article, “The Goos-Haenchen shift ... takes on equal but opposite values for the lossy and gainy cases.” No, the shift is almost the same as in the case of lossless media.

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v.ignatovi@gmail.com

**THE AUTHOR RESPONDS:** I appreciate this response from F.V. and V.K. Ignatovich. However, I continue to believe that my description of Fresnel reflection, and especially of total internal reflection from a lower-index but gainy medium, is the physically correct one. Some of their responses seem to me to reflect simply differences in sign conventions; others

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represent varying interpretations of the physical effects involved.

The analysis of optical wave propagation, optical waveguiding and optical interference effects in the presence of gain can be tricky, however, and can lead to seemingly non-intuitive effects. There has been more than a little disagreement on these topics in the optics literature. So, I believe that all of us will welcome further responses to their views and mine, and further discussion of these topics, whether in optics journals that are more suited to extended technical debates, or perhaps in other channels such as Internet websites and online media.

Beyond this, if anyone is motivated to attempt careful experimental tests of these contested phenomena, that could be a challenging but rewarding contribution as well.

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Palo Alto, Calif., U.S.A.

### Hermann von Helmholtz: A 19<sup>th</sup> Century Renaissance Man

Thank you for writing the truly excellent article about Helmholtz in OPN (March 2010). I enjoyed it very much and learned more about this great man. His influence will be felt for untold years to come.

In your study of Helmholtz, I wonder if you came across any mention of him having been influenced by or collaborating with J.B. Listing. Listing published *Beiträge zur physiologischen Optik* in 1845, which became a classic for those in the field. Listing, as I expect you know, began the serious field of study of the optics of the human eye and remained a major player in physiological optics for several decades.

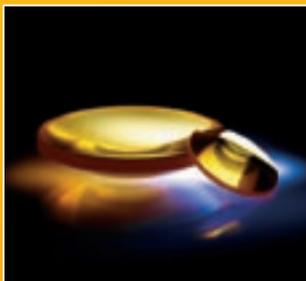
**R. Barry Johnson**  
Normal, Ala., U.S.A.  
barry@w4wb.com

**THE AUTHOR RESPONDS:** It is kind of you to inform me about the classic work of Professor J.B. Listing. I was not aware of Listing's contribution to the study of the eye, nor have I read anything that indicated the direct influence of Listing on the optical studies of Helmholtz. It seems plausible that Helmholtz read that classic work. Your kindness in posing the question and sharing your knowledge on the subject with me is an exemplar of how all of us in the scientific community can work together to further scholarly work.

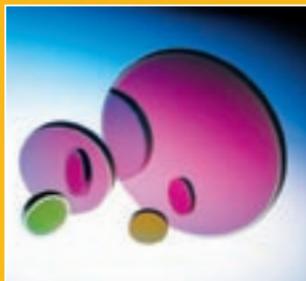
**Barry R. Masters**  
Cambridge, Mass., U.S.A.  
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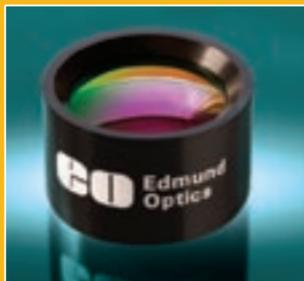
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