in 1963 it was shown that the influence of a
crystal field on gaseous transport properties
was not limited to paramagnetic molecules but
was a general property of all rotating molecules.
This paper reviewed the field at that time. [The
SCImago indicates that this paper has been cited
in over 210 publications.]

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A remark by C.J. Gorter, well known for his
low-temperature research on magnetism in
Leiden, drew my attention to the fact that the
Senftleben effect1,2 still had some poorly un-
derstood aspects. I was just starting work in
the field of molecular physics and, to be hon-
est, I did not even know that such an effect
existed, although kinetic theory had always fas-
cinated me. Gorter explained to me how the
precession of the magnetic moment of para-
magnetic molecules, such as oxygen, gives rise
to a change in the transport properties of these
gases, an explanation that he came up with first.

In the late 1950s a central problem in kinetic
theory of simple gases was the influence of the
definite interaction between molecules on
the gaseous properties. It was also the time
of the revival of molecular beam-scattering ex-
periments. One day I was considering the pos-
sibility of using polarized beams to get infor-
mation on nonsphericity effects in collisions.
The most elegant way seemed to be by com-
paring the polarized situation with the non-
polarized one. From studies of molecular
beams I had learned that all rotating molecules
had a small magnetic moment arising from
their rotation. So I considered the possibility of
using the precession of the moment in a
magnetic field to depolarize the beam.

When I remembered Gorter's story on the
Senftleben effect, I suddenly realized that all
rotating molecules ought to show an effect
similar to that in a magnetic field there under similar precession conditions; the small-
er magnetic moment required only larger fields
and longer free-flight time to make the pre-
cession mechanism effective. This was the ba-
sis of an experimental breakthrough in Leiden.
Near the same time, in Moscow, Yu.M.
Kagan showed how the distribution of mole-
cular angular momentum was no longer isotro-
pic in the presence of a gradient of a macro-
scopic property, such as temperature. Togeth-
er with L.A. Maksimov4 he was able to ex-
plain Senftleben's results on oxygen in terms of
precessional destruction of this nonequilib-
rium polarization.

Also at that time, in Vancouver, Bob Snider
had a PhD student, F.R. McCourt, working on
the role of molecular angular momentum in transport properties. Returning from his (and L.
Waldmann's from Erlangen) quantum mechan-
ic extension of the Boltzmann equation. Dur-
ing the course of his work McCourt became
familiar with both the Leiden and the Moscow
results. The combination of the two was the
subject of his thesis. Subsequently, he went as
a postdoctoral fellow to the Leiden group. This
was the start of a fruitful and still-existing co-
operation. One result was the 1970 paper.
Why has this paper been cited so often? I
guess because the generalized Senftleben ef-
fect became an important tool in the study of
polyatomic gases. The paper is still the most
easily accessible introduction to the subject.
In fact, so far, no modern book on kinetic the-
ory adequately treats rotating molecules as
well, a gap we hope to fill shortly.5

The idea of the role of anisotropy in angular
momentum—"nonequilibrium polarization"—
had been a fruitful one. Not only has it been
applied to the dilute gas regime, but it has also
proven to be a useful tool in studying the
rarefied gases, the effects of molecular
orientation in boundary-layer phenomena and
in molecule-surface collisions.6,7

1. Senftleben H. Einfluss eines Magnetfeldes auf das Wärmevermögen von paramagnetischen Gasen (Effects of magnetic
2. ---. Magnetische Beeinflussung des Wärmespeichereigens paramagnetischer Gas. (Further studies concerning the
3. (Cited 80 times since 1955.)
Naturwissenschaften 26:140, 1938. (Cited 35 times since 1955.)
(Preparation.)
8. Borman V D, Krylov S U, Maksimov L A, Nikolaev B I & Troyan V I. On kinetic thermomagnetic phenomena in