Comment on "Geomagnetically Trapped Radiation"

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BAKER'S[1] very thorough and clear exposé on geomagnetically trapped radiation does not mention one invariant that is truly invariant as long as the magnetic field has an axis of rotational symmetry. This is the moment of generalized momentum of the particle corresponding to the axis of rotational symmetry of the field. The invariance is well explained by Brillouin[2] who refers to Larmor.[3] The invariance along a trajectory of the axial moment of generalized momentum is exact even for time varying fields and relativistic particles. Using the relativistic expression for kinetic energy and the invariance of the axial moment of generalized momentum, one easily finds contours between which the particle must remain.

References

[1] Baker, M. B., "Geomagnetically trapped radiation," AIAA J. **3**, 1569–1579 (1965).
[2] Brilloun, L., "A theorem of Larmor and its importance for electrons in magnetic fields," Phys. Rev. **65**, 260–266 (1945).
[3] Larmor, J., *Aether and Matter* (Cambridge University Press, Cambridge, England, 1900).

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Equilibrium Properties of Argon

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IN the course of recent spectrographic analyses of the radiation from the settling chamber of an arc-heated argon wind tunnel,[1] it proved necessary to be able to determine the stagnation temperature and the ionization fraction of the working fluid as a function of the measured enthalpy and gas pressure to some accuracy at temperatures as low as perhaps 4000°K. As the currently available Mollier diagrams do not readily lend themselves to accurate interpolation in this region, it was felt necessary to recalculate these data and present them in a more detailed form.

The computations are based upon the usual methods of statistical thermodynamics, assuming complete chemical equilibrium and considering the first stage of ionization only.[2] A range of nondimensional enthalpy H/RT_0 up to 400 is considered, this being the maximum attainable in the facility employed, the calculations being performed at 26 increments of pressure from 1.0 to 0.01 atm. The corresponding maximum temperature attained approaches 14,000°K, under which conditions the gas is approximately 40% ionized.

The data are presented in the form of a table of values of enthalpy and ionization fraction over the prescribed pressure range at temperature intervals of 100°K commencing at 1000°K. The temperature-enthalpy-pressure characteristic also is available in the form of a large scale diagram chart. Copies of these data may be obtained, upon request, from the author.

References

[1] Adcock, B. D. and Plumtree, W. E. G., "On excitation temperature measurements in a plasma-jet, and transition probabilities for argon lines," J. Quant. Spectr. Radiative Transfer **4**, 29–39 (1964).
[2] Arave, R. J., "Thermodynamic and normal shock properties of the inert gases in ionization equilibrium," Boeing Co., Seattle, Wash., Rept. D2–22291 (1963).

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Erratum: Effect of Cone Angle and Bluntness Ratio on Base Pressure

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THE technical note for which the above is the correct title was printed under the erroneous title, "Ratio on Base Pressure."

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