A Brief Case for Fast Entropy and an eth Law

by Mark P. A. Ciotola[1], mciotola@pavilionrc.com

1 The eth Law—Fast Entropy

The author has advocates that the Second Law can be extended by stating that not only will entropy tend to increase, but also it will tend to do so as quickly as possible. In other words, entropy increase will not happen in a lazy, casual way. Rather, entropy will increase in a relentless, vigorous manner. The author describes this extension as an eth of Thermodynamics[2] or, more simply, Fast Entropy[3]. The **e**th Law gives teeth to the Second Law.

Actually, the **e**th Law is already widely practiced astrophysicists and atmospheric scientists, although not by that name.[4] Whether a stellar or planetary atmosphere tends to convect or radiate depends on which results in the greatest heat flow. The maximization of heat flow results in the maximization of entropy increase, so this scenario represents the **e**th Law in action.

2 More Precise Statement of eth Law

The eth Law needs to be stated more precisely to be of much use. A more precise statement is that "entropy increase shall tend to be subject to the principle of least time."[5]

---

[1] The author is not a professional physicist, but rather runs a financial forecasting firm. The **e** th Law is used as a basis for financial modeling by this firm.

[2] e in eth law referring to the transcendental number e, that is 2.718. The author's primary use for the **e** th law is modeling exponential growth where thermodynamic potentials are involved..

[3] The term Second and A Half Law of Thermodynamics could improve pedagogy.

[4] A form of this extension is already in use by astrophysicists and meteorologists. When modeling atmospheres, their models will tend to choose the form of energy transfer that maximizes heat flow, such as convection versus conduction or radiation. See B. Carroll and D. Ostlie, An Introduction to Modern Astrophysics, 2nd Ed., Pearson Addison-Wesley, 2007, p. 315.

[5] The principle of least time is a general principle in physics that applies to diverse areas such as mechanics and optics. Snell's Law of Refraction is an example.

3 Physical Examples

Neither the e[th] Law nor Fast Entropy will be found in a typical physics textbook, although it could said to fall under non-equilibrium thermodynamics or transport theory discussed in some texts. Nevertheless, a few simple examples can be offered to support the validity of Fast Entropy.

One example is heat flow through two parallel conductors each bridging the same two thermal reservoirs (Figure1). No matter what area, materials or other characteristic comprise each of the conductors, the percentage of heat that flows through each conductor is always that which maximizes total heat flow. In this case, when total heat flow is maximized, so to is entropy production maximized.

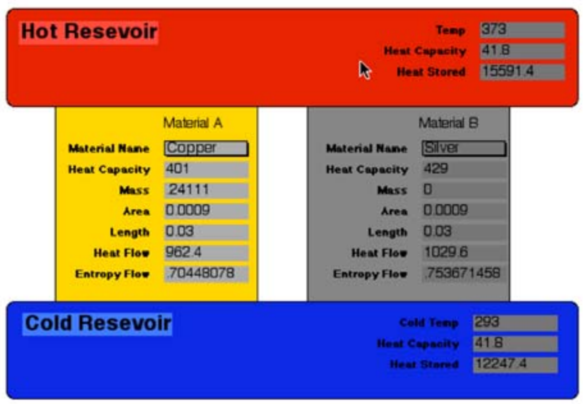

FIGURE 1 Parallel heat conductors

Another example is heat flow through conductors in series between a warmer and cooler heat reservoir. This example replicates the classic demonstration the applicability of the Principle of Least Time in optics (Snell's Law), but using thermal conductors in place of refractive material, and replacing the entrance point of light with a contact point with a warmer reservoir and the exit point of light with a contact point with a cooler reservoir (Figure 2).

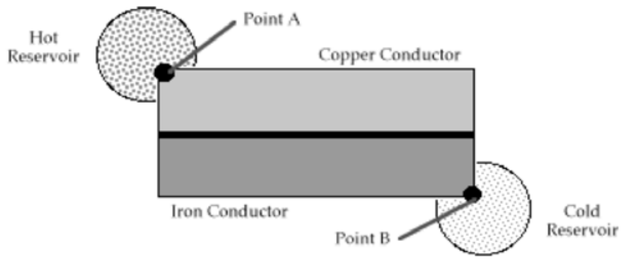

FIGURE 2 Heat conductors in series

While heat flow tends be a nebulous affair, the path of maximum heat flow can be ascertained. This can be accomplished by noting perpendicular paths to isotherms indicated by placing temperature sensitive color indicator film upon the conductors (Figure 3). The greatest color change gradient represents the path of maximum heat flow. Observations show that the path of maximum heat flow is consistent mathematically with Snell's Law (which is based upon the principle of least time but usually reserved for light rays). This example is admittedly bush-league, yet it is reasonably easy to replicate.

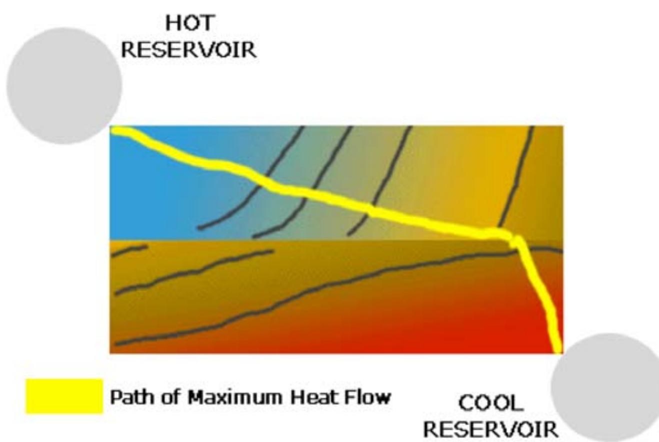

FIGURE 3 Heat conductors in series with isotherms

As mentioned above, a third example is well known to atmospheric scientists. Here, in an atmosphere where heat is flowing from a warm planetary or stellar surface, whether thermal radiation or conduction will occur tends to be dependent upon whichever produces the greatest heat flow. Whichever produces the greatest heat flow tends to produce the entropy most quickly.

R

References

References (also see footnotes and appendices)

Burt, J. A., "The thermal-wave lens", *Can. J. Phys.* **64**: 1053, 198681995.
Ciotola, M. "Factors Affecting Calculation of L", Kingsley, S., R. Bhathal, ed.s, *Conference Proceedings*, International Society for Optical Engineering (SPIE), Vol. 4273, 2001.
Ciotola, *Hurtling Towards Heat Death* (talk delivered at San Francisco State University). September, 2002.
Prigogine, I., *Introduction to Thermodynamics of Irreversible Processes*, Wiley, New York, pp. 67. ff., 1967.
Schroeder, D. V., *Introduction to Thermal Physics.* Addison Wesley Longman, 2000.
Stowe, K., *Introduction to Statistical Mechanics and Thermodynamics*. John Wiley & Sons, 1984.

Note on references:

The author independently conceived the statements made in this pamphlet. However, so many people have written on thermodynamics, that the author does not claim the statements are new. Nevertheless, to the author's knowledge, the author is the first to synthesize all of these statements into an integrated whole. The author has subsequently been introduced to relevant the prior work of J. A. Burt, M. K. Hubbert, Meadows, R. Swenson and I. Prigogine who have themselves discovered some of the major pieces.

Points of Contact

Points of Contact

Fast Entropy Research Site

www.fastentropy.org

Fast Entropy Press Commercial Site

www.fastentropy.com

Pavilion of Research and Commerce
210 Fell Street, San Francisco, California 94102
www.fastentropy.com • www.fastentropy.org

Second Edition Version Beta 0.1