Chapter 10.1 - The Cooling Coffee Problem Revisited

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author: Clayton Johnson

date:

autosize: true

Physical Interpretations

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While $U - u\_s > 1$, we have that

$$

(U-u\_s)^{\frac{5}{4}} > (U-u\_s).

$$

However, since

$$

\lambda\_{\text{natural cooling}} = 0.0115, \\

\lambda\_{\text{Newton cooling}} = 0.0288,

$$

the effective rate of natural cooling is lower than Newton cooling.

Summary of Equations

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Newton's law of cooling is

$$

\frac{dU}{dt} = \pm \frac{hS}{cm}(U-u\_s).

$$

The natural law of cooling is

$$

\frac{dU}{dt} = \pm \frac{h\_1 S}{cm}(U-u\_s)^{\frac{5}{4}}.

$$