# Thermal Physics

PHYS 358

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LaTeXed by Sibelius Peng

# Preface

**Disclaimer** Much of the information on this set of notes is transcribed directly/indirectly from the lectures of PHYS 358 during Spring 2021 as well as other related resources. I do not make any warranties about the completeness, reliability and accuracy of this set of notes. Use at your own risk.

This notes is not as comprehensive as the instructor's notes, but served as a quick reference guide.

Schroeder's *Introduction to thermal physics* (SITP) is the textbook.

Chapter 1 is *UW Phys 358 course module organization*, chapter 3 is *Some abbreviations, symbols, and housekeeping matters*, which are omitted in this set of notes.

For any questions, send me an email via https://notes.sibeliusp.com/contact.

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# 2

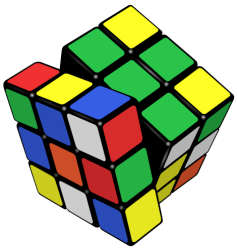
# Introduction

What is "thermal physics"? It could be defined possibly all things relating to temperature. Then what is temperature? There's a formal definition of temperature:

$$T := \left(\frac{\partial U}{\partial S}\right)_{\text{no work}}. \tag{2.1}$$

where $U$ is the internal energy of the system, and $S$ is the entropy of the object. What does "no work" mean? The first law of thermal dynamics tells us there are two ways that energy can leave or go into a system, heat and work:

$$\Delta U = Q + W\,.$$



# Part I:

# Macroscopic phenomenological thermal physics

In this part, we will define temperature empirically and gain familiarity with its use on the macroscopic level; i.e., mainly without using any knowledge of the atomic nature of matter. Such an approach is useful but limited. Nonetheless, this part will provide a physical context for the discussion of the precise definition of temperature (2.1) in the next part. Also in this part we will clarify the difference between the two mechanisms by which energy can flow into or out of a system: heat and work, establishing what the "no work" constraint means in (2.1).

# 4

# Liquid-in-glass thermometers