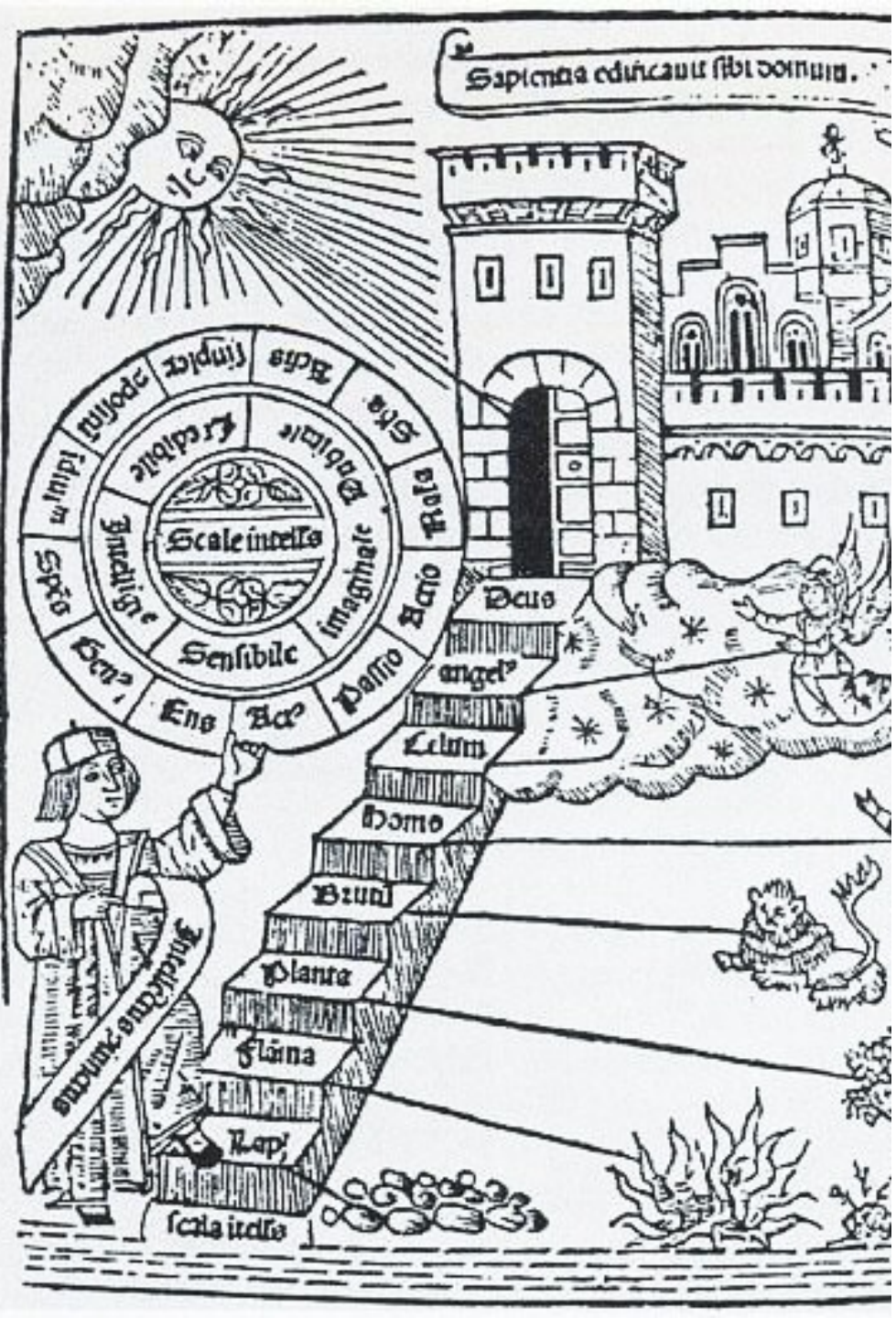

Fundamentality in Metaphysics and Physics

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Modules: MA3

Structure

1 Introduction

2 Defining (Absolute) Fundamentality

3 Foundationalism

4 Rejecting Foundationalism

5 Fundamentality in Physics

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1. Introduction

1.1 The Notion

Democritus (…) went a step further to say that all matter is made of **fundamental** particles that are indestructible. He called these particles atoms, meaning "indivisible" (…) The field of particle physics **seeks to continue studying these same concepts**. Are there **fundamental**, indivisible particles and if so, what are they? How do they behave? How do they group together to form the matter that we see? How do they interact with each other? (…) It was found that **there really is just a small, finite set of fundamental particles, some of which can be grouped together to make up larger objects.** (…) The elementary fermions are the **building blocks of all other matter**.

(Robinson et al. 2008: 127)

1. Introduction

Reality is a rather large place. It contains protons, flamingoes, economies, headaches, smiles, asteroids, crimes and numbers (…) Much of the content of our reality appears to **depend** on other of its content (…) Some of the content of our reality also appears to be, in some significant sense, more important than other of its content (…) The **content of reality** to which these parts give rise is **arranged relatively neatly into layers**: facts about economies and crimes reside at higher level than facts about biological systems, which reside at a higher level than facts about chemical systems and so on (…) they are further up the **Great Chain of Being** (…) This picture, or something like it, looms large over contemporary metaphysics: a picture according to which **reality is hierarchically arranged** with chains of entities ordered by relations of dependence terminating in something **fundamental**.

(Bliss & Priest, 2018: 1)

1. Introduction

1.2 The Tasks of Fundamentality

- Capture the idea that there is a 'foundation' of being, and that everything else depends on fundamental entities.

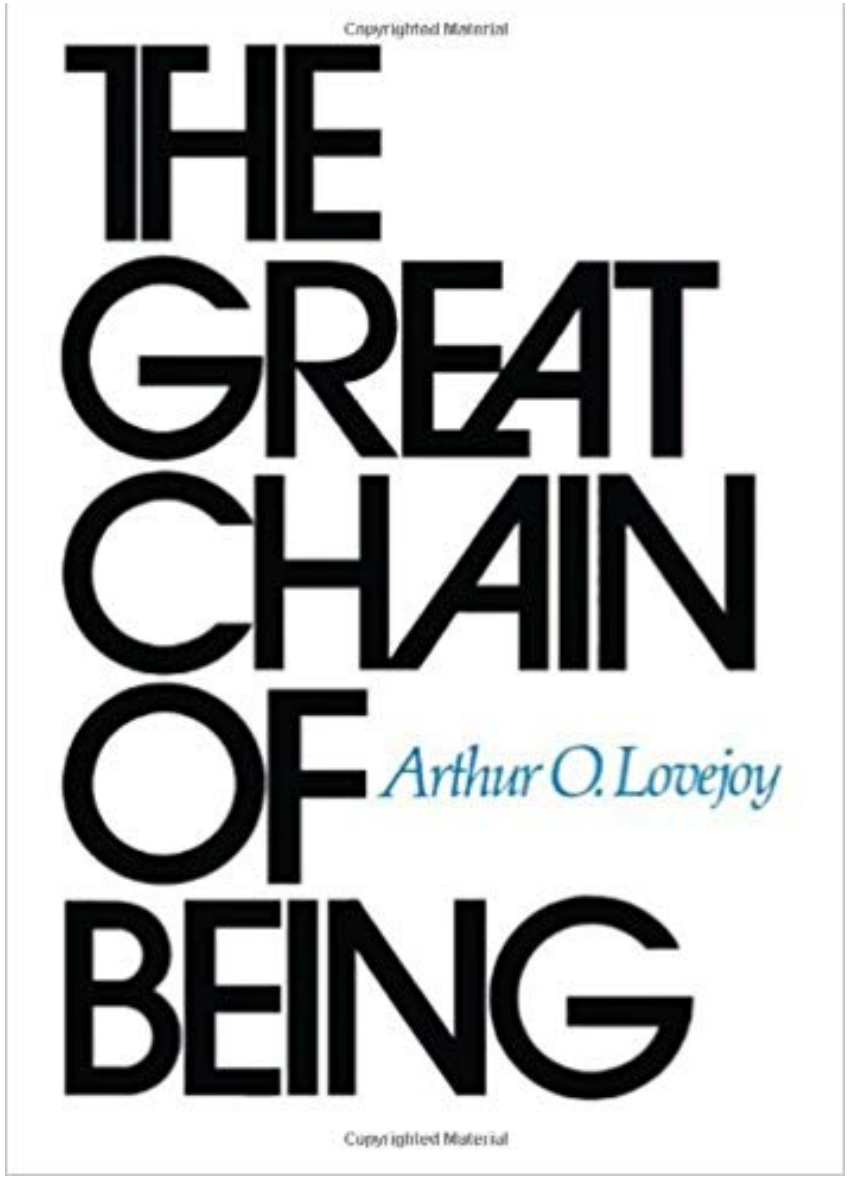
- There is a hierarchy of being, whereby some entities are more fundamental than others.

- Arguably, the first entails the second but not vice-versa.

1. Introduction

1.3 The History of the Notion

- Atomists (Atoms and the Void)
- Plato (Forms)
- Aristotle (First and Secondary Substances)
- Medievals and Early Modern (God)
- Heidegger (Being)
- Indian Abhidharmika (Dharmas, simple tropes)
- Nishida (Consciousness)



2. Defining Fundamentality

2.1 Absolute Fundamentality

(AF): x is fundamental ≡ x does not *depend* on any y (with $x \neq y$) in *any metaphysical* sense (Tahko, 2018: 3).

- **Problem.** Metaphysical dependence is an umbrella term for *many* relations (cfr. *composition*, *constitution*, *set-formation*, *realization*, *micro-based determination*, *grounding*, *ontological dependence* ---**Bennett, 2017**). There is no guarantee they point in the same direction. Some entities we would like to regard as fundamental will not turn out to be, given (AF).

- **Case in point.** Quarks: mereologically independent but ---arguably--- existentially dependent.

2. Defining Fundamentality

2.2 Relative Independence

(RI): For some privileged metaphysical dependence relation R, x is fundamental $\equiv$ x does not depend on any y (with $x \neq y$) in this privileged sense (Tahko, 2018: 5).

(RI): Fundamentality$_R$: x is fundamental$_R$ $\equiv$ There is no y, $x \neq y$, such that x is R-related to y ---or to some zz that include y (Calosi, Forthcoming; **Bennett, 2017**).

○ As close to a standard conception as we are likely to find. We shall refer to this as **Independence**.

2. Defining Fundamentality

- **Question.** Are they co-extensive? They might not be. **Case in point**: Priority Monism.

- Is there are privileged subset of relations of metaphysical dependence that track fundamentality?

- No. Does the notion of fundamentality play any role on top of the various notions of metaphysical independence? (Cfr. Big-G-relation VS small-g-relations, Wilson, 2014).

- Yes. There is only one (**Schaffer, 2009**). There's more than one. What is that unifies them? Formal Profile (**Foundationalism** and **Bennett, 2017** ---building relations).

2. Defining Fundamentality

2.3 Complete Minimal Basis

(CMB): x is fundamental ≡ x belongs to a plurality yy that provide a complete basis that determines everything else, such that no proper sub-plurality of yy is complete (Tahko, 2018: 9).

- **Issues.** What sense of '*completeness*' (e.g. modal would not do)? What sense of '*determination*'? What is the relation of (CMB) with famous attempts in the history of philosophy such as *reduction* or *supervenience*?

- **Tearing the Two Definitions ---(Independence) and (CMB)--- Apart.** Metaphysical Coherentism. Suppose symmetric relations of dependence are possible. Symmetric dependent entities might qualify as fundamental under (CMB), but not under (Independence). **Case in point**: quarks.

2. Defining Fundamentality

- We will not consider an alternative approach in defining fundamentality, i.e. one that uses **naturalness** (Sider, 2011; Fine, 2013).

- We will not even consider **primitivism**, i.e. the view that we should take fundamentality as a primitive (Fine, 2001; Wilson, 2014; Wilson, 2016).

- We will however talk a little about defining **Relative Fundamentality** (**Bennett, 2017**; **Correia, Forthcoming**). This may be helpful if we want to stick to Task II, without thereby committing ourselves to Task I.

3. Foundationalism

3.1 Metaphysical Foundationalism: The Thesis

- Recall the tasks of Fundamentality: a hierarchy of being that terminates in something fundamental.
- Recall the definition of Relative Independence and the challenge. What unifies ---if anything---the fundamentality-tracking relations of metaphysical dependence?
- Recall one of the possible answers: the formal profile.

3. Foundationalism

Hierarchy Thesis: (Necessarily), reality is hierarchically structured by metaphysical dependence relations (that share a common formal profile);

The Fundamentality Thesis: Necessarily, something is fundamental;

The Contingency Thesis: Whatever is fundamental is a contingent entity;

The Consistency Thesis: The dependence structure has consistent structural properties.

(Bliss and Priest, 2018: 2)

3. Foundationalism

- **Radical Foundationalism**: every fundamentality-tracking relation *R* of metaphysical dependence is a *well-founded strict partial order*. Something is fundamental iff it is a minimal *R*-element.

- *R* is *irreflexive* (IR), *asymmetric* (AS), *transitive* (T), and *well-founded* (in the set-theoretic sense). Yet, there is a raging controversy on how to capture the sense of well-foundedness that is relevant here (Dixon, 2016; Rabin and Rabern, 2016).

- **Extendibility E:** A fundamentality-tracking relation *R* of metaphysical dependence is extendible iff for every x there is a y, with $x \neq y$, such that x depends$_R$ on y (Bliss and Priest, 2018: 7).

3. Foundationalism

- Are there any explicit arguments? More like intuitions pumps (But see Raven, 2016).

- The most quoted intuition pump comes from Schaffer: "Being is infinitely deferred and never achieved" (Schaffer, 2010: 62).

	IR	AS	T	E	Comments
1	Y	Y	Y	Y	Infinte Partial Order
2	Y	Y	Y	N	Partial Order
3	Y	Y	N	Y	Loops
4	Y	Y	N	N	Loops
5	Y	N	Y	Y	X
6	Y	N	Y	N	X
7	Y	N	N	Y	Loops of Lenght >0
8	Y	N	N	N	Loops of Lenght >0
9	N	Y	Y	Y	X
10	N	Y	Y	N	X
11	N	Y	N	Y	X
12	N	Y	N	N	X
13	N	N	Y	Y	Pre-Order
14	N	N	Y	N	Pre-Order
15	N	N	N	Y	Loops of Any Lenght
16	N	N	N	N	Loops of Any Lenght

3. Foundationalism

- **Explanatory Arguments and Regress:** "Given a Truth that stands in need of explanation, one naturally supposes that it should have a 'completely satisfactory explanations', one that does not involve cycles and terminates in truths that do not stand in need of explanation" (Fine, 2010: 105) --- See (**Bliss, 2013**).

- **Theoretical Virtue Argument.** "Cameron argues that a theory of reality on which we have a unified explanation of everything that needs an explanation is more virtuous than one in which we have no such unity. And metaphysical foundationalism, unlike its rivals, is just such a theory, according to Cameron" (Bliss and Pries, 2018: 25 on **Cameron, 2008**).

4. Against Foundationalism

4.1 Infinitism. The Denial of "Well-Foundedness"

- **The Mereological Argument.**

Mereological relations are fundamentality-tracking. Hunky worlds are possible. There are no fundamental$_C$ ---*C* for "composition"--- entities at hunky worlds. Against the **Fundamentality Thesis** (Tallant, 2013; Bohn, 2018).

- A world *w* is *hunky* iff it is both *gunky* ---everything has a proper part, and *junky* ---everything has a proper extension.

4. Against Foundationalism

- **Arguments from Physics ---from Morganti (2015).**

(i) "Effective quantum field theories might form an infinite tower that goes down to arbitrary short distances in a kind of infinite regression […] just a series of layers without end" (Georgi, 1989: 456).

(ii) Dehmelt's model of elementary particles based on infinite regression (Dehmelt, 1989).

4. Against Foundationalism

4.2 Coherentism. The Denial of Asymmetry

- **Quantities. "**The mass, density, and volume of a portion of a homogenous fluid are interrelated in such a way that the value of any two of the three parameters might be said to ground the value of the other" (Fine, 2011: 8).

- **North-South Pole of a Magnet.** "Wihout the north pole the south pole would not exist and without the south pole the north pole would not exist" (Bliss and Priest, 2018: 14).

4. Against Foundationalism

- **Moderate Ontic Structural Realism.** Objects depend on irreflexive and symmetric relations, and these relations depend on objects (Esfeld and Lam, 2008).

- **Entanglement.** Entangled particles depend on each other for their qualitative profile ---more specifically, for the entangled degrees of freedom (Calosi and Morganti, Forthcoming).

- **Quantum Chromodynamics.** Quarks can be regarded as mutually existentially dependent.

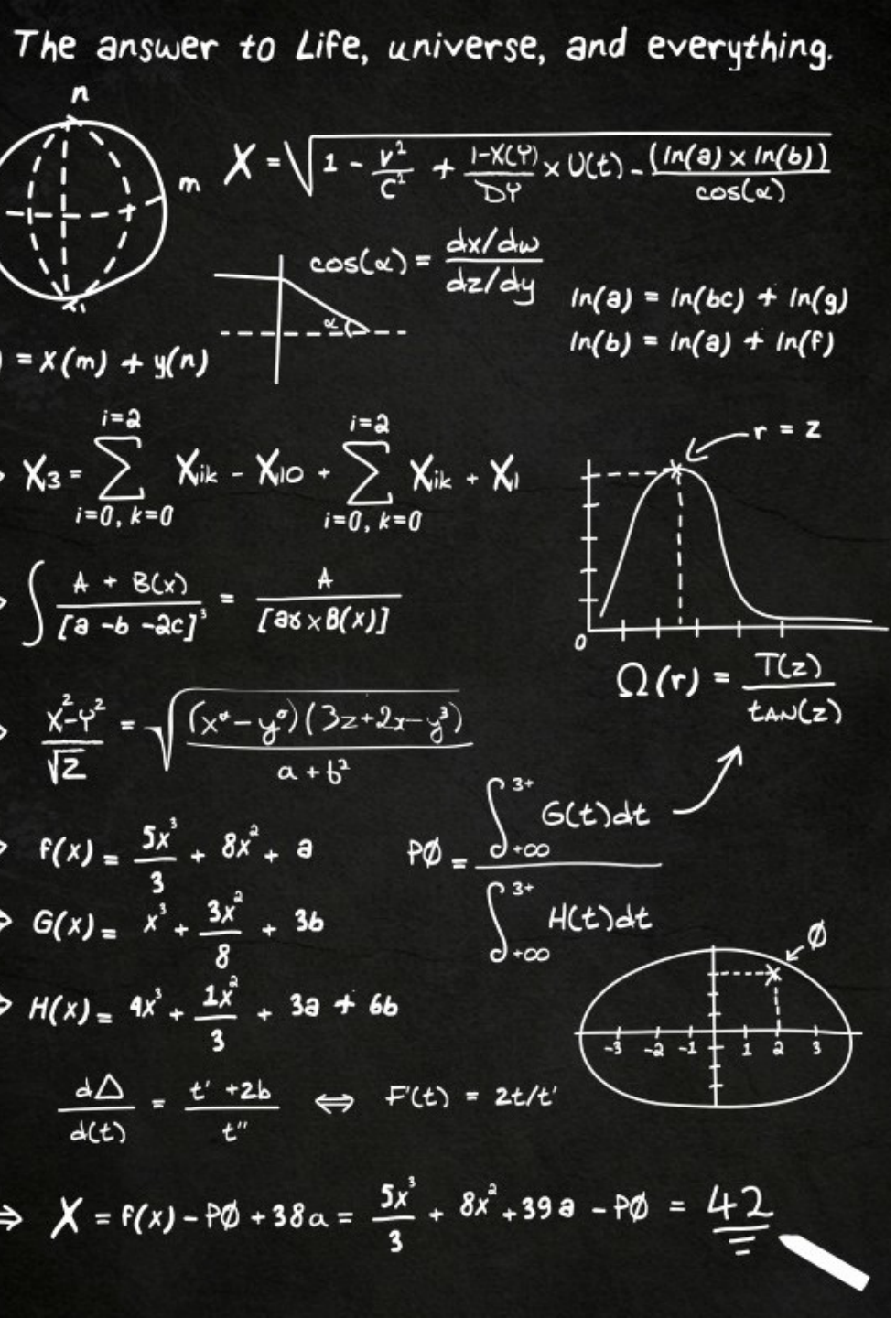
5. Fundamentality in Physics

- Very different entities are said to be fundamental (or not): *objects* (such as particles, fields, spacetime regions), *events*, *properties*, *forces*, *laws*, *symmetries*, *theories* and so on (**Healey, 2017**; **Hoefer, 2003**; **Hoefer & Smeenk, 2016**).

- As a matter of fact, sometimes *physics itself* is said to be fundamental (**Ney, Forthcoming**).

- Arguably, a very simplistic picture such as: "A fundamental law is a law of a fundamental theory. Properties and bearers of properties that are mentioned in the fundamental laws are fundamental" would not do ----even granting we know how to characterize a fundamental theory (**Crowther, Forthcoming**).

- Is the notion of fundamentality of any help in physics? (**McKenzie, 2011**).



$6 \times 7 = 42$. Conclusion

"I always thought there is something **fundamentally wrong** with the universe".

(Douglas Adams, 1979, *The Hitchhiker's Guide to the Galaxy*)