# On the Observability of the Graviton Particle

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## Abstract

The graviton particle is predicted to carry the force of gravity. But, since we have yet to observe a graviton, we cannot say for sure that this is the only behavior it has; it could also behave similarly to other particles in the Standard Model. Observation of a graviton is necessary to rule this out, otherwise we cannot say for sure whether we have a known particle or a graviton behaving like one. This paper outlines four justifications for why this observation will never happen.

## Introduction

The Standard Model of Physics predicts the existence of a particle, called a “graviton,” that carries the force of gravity (Tanabashi et al., 2018, 33). But, since we have yet to observe a graviton in nature, we cannot say for sure that this is the only behavior it has; it could also behave similarly to other particles in the Standard Model. We need to observe a graviton first before we can rule this out. Otherwise we cannot say for sure if the particle we believe we have in front of us isn’t really a graviton *behaving like* the particle we believe we have.

Unfortunately, if the justifications below are valid, then this observation cannot happen; we will never be able to say with any certainty if we have the particle we think we do.

# Justifications

## Theoretical

Einstein's General Relativity describes gravity as curved spacetime (Andréka et al., 2007, 608). If this is correct, then even though it may be useful to think of gravity as a force, it is not a force and thus requires no particle to carry it. Therefore no observations could be made.

## Physical

When physicists "observe" a particle, it means that a device detected the behavior of some small amount of energy and, by process of elimination, determined what particle it must be (Chu, 2015). This poses a problem, though. A graviton would need mass as the source of its gravity, and all mass has some non-zero amount of electric and magnetic activity (Gross, 2006, 3). But devices for detecting particles already have this description; the device would simply see the energy as an electromagnetic mass, and determine the appropriate description based on particles in the Standard Model that we've already observed. Any attempt to put a graviton in front of a detector will always result in that detector confusing it for something we already know.

## Philosophical

Once we observe a graviton, we will have the ability to isolate and remove it and all other particles from some point in space (Vienna University of Technology, 2019). If we do, then what's left behind? The Standard Model is predicated on the idea that everything in the universe is describable by particles (CERN, n.d.). This means whatever that "nothing" is that's left behind must also be describable by particles. But if this is the case, then what’s left behind after we observe, isolate, and remove *those* particles? We end up in a recursive loop with no way out.

## Logical

Even though there may be quantum particles still to observe, ultimately their collective behavior is still constrained by the Periodic Table, which means we still have a complete description, if only at the atomic level. But gravity is separate from this, and does not have some “higher level” description that we know (Choi, 2018). Observation of a graviton particle itself then is necessary to get this complete description of gravity, and once done, would then necessarily provide a complete description of all energy. Logically, then, this would also give us a complete description of no energy, but this isn’t allowed. “No energy” is known in physics as “absolute zero”, and since the terms “observation” and “complete description” can be considered equivalent, we would essentially be able to observe absolute zero, which is forbidden by the Third Law of Thermodynamics (Masanes & Oppenheim, 2017, 2). Proof by contradiction.

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