

Anne Pfeifle  
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Civitas 395 Essay

At first glance, the search for dark matter doesn't seem like something Bonhoeffer would be interested in—dark matter is invisible. But that is where Bonhoeffer's interest would lie. He had tremendous faith, another unseen thing. He spent his short life writing about his faith and his role in the world, not knowing what, if any, impact there would be. Despite uncertainty, he worked with many people and urged that their work should happen in the world. Dark matter scientists are doing just that (and working in space). If he were alive today, I think Bonhoeffer would agree that the search for dark matter is a vocation.

Dark matter is theoretical at this point; we don't have any direct evidence for it, yet. However, physicists theorize its existence based on several factors. First, based on observations of the movement of galaxies, we know there is more mass in the universe than we can see. Second, light from distant stars is bent more than it would be absent something interfering with the light. This also indicates that there is more mass in the universe than we can see using our normal observational tools—that is, the electromagnetic spectrum. Scientists named this matter, that does not interact directly with light, “dark matter.”

Scientists hypothesize that dark matter will interact not only with gravity, but something called the “weak force” as well. The weak force governs interactions between the nuclei of atoms. This means that we can detect dark matter when it runs into other atoms, which is the basis for the project called DarkSide (Depleted Argon Cryostat for Scintillation and Ionization Detection). The program's detector is filled with liquid argon, a liquefied noble gas, like helium, but heavier. When a dark matter particle enters the detector, and collides with an argon nucleus, a burst of light will be given off. The light is detected with special instruments known as photomultiplier tubes, or PMTs. The liquid argon,

components of the detector, and PMTs are specially manufactured so that they have the least amount of radiation-emitting sources as possible.

DarkSide will find dark matter, but it also promotes collaboration between disciplines. Geologists must evaluate the underground sites where the detectors will go. Theoretical physicists predict what a dark matter particle and argon nuclei interaction will look like. Experimental physicists analyze the data the detector produces. Engineers build the detector and liquefy the argon. Computer scientists build the code necessary to analyze the data. But I think too that DarkSide offers some metaphysical questions to ponder as well. What are the implications of the fact that we share our universe with something we can't see yet are willing to spend decades and millions to study it? Is this just?

According to Bonhoeffer, "Vocation is the place of responsibility, a calling to life that both answers the call of Christ and the call of fellow human beings in the real world" (Civitas handbook). In the most literal sense, those of us working on DarkSide answered a call: for scientists to come together to further the collective knowledge of humans. To those working on the project, theirs is a high calling; it is the pursuit of pure knowledge. DarkSide collaborators are interested in knowledge for knowledge's sake. Perhaps a practical use will result from the direct detection of dark matter. For example, when lasers were invented, there was no useful application for them. Today, however, lasers are used widely, from scanning barcodes, to reading CDs and DVDs, to surgery, to playing with cats. Perhaps scientists will find a use for dark matter. But that's not why I, and the other collaborators, work on this project. We're not hoping that maybe dark matter detection will be useful. We're not hoping that we could discover something that could be commercialized. Instead, by knowing how our world and our universe work, we (or at least I) hope to better understand our place in it.

The foundation of the Civitas program is Bonhoeffer's work, and especially his essay, "The Structure of a Responsible Life," which defines the structure of life in a twofold manner: life's bond

between humans and God and the freedom of one's life (Bonhoeffer). A part of the structure of the bond is "accordance with reality" (Bonhoeffer, 257). Furthermore, "misunderstanding accordance with reality amounts to irresponsibility" (Bonhoeffer, 222). Bonhoeffer stresses that accordance with reality is not blind service to facts (221). And I want to be sure to do the same, but I do think that to live in accordance with reality, we must know what that reality is. And as of now, science is our best tool to get at that reality.

It is tempting, and easy, to cast the two as enemies—that science and faith cannot be reconciled. But Bonhoeffer has the answer. If science gets at reality, faith reaches the accordance part of the equation: "only in and from Christ is it possible to act in a way that is in accord with reality" (Bonhoeffer, 223). Science gives us the reality; Christ allows us to act in that reality.

Though Christ allows us to act in a reality where there is dark matter, what are we to do with this information? It's difficult to see how dark matter affects our day to day life, our interactions with fellow humans. I think, though, that the specific project is less important than the process of scientific collaboration. This is not to devalue the DarkSide project, or my own contribution, but to say that collaborative science is a vocation, in the sense that Bonhoeffer wrote about. It is the "place at which one responds to the call of Christ and thus lives responsibly" (Bonhoeffer, 292). Limiting the scientific vocation would be "a limitation of irresponsibility" (Bonhoeffer, 295). The grace of God claims us in the place where we are (Bonhoeffer, 291). Science's role is to tell us more about that place.

Dark matter detection represents a large place as it is a project large in scope. The argon from the detector comes from Colorado; the prototype of the detector is in Italy while the final detector will be in Lead, South Dakota; and scientists working on the project are based at institutions all across the world, from the United States to China to the United Kingdom. DarkSide represents one of science's greatest qualities—it brings people from all over together in search of a common goal.

Though our primary goal is finding dark matter, many other things are accomplished by DarkSide. The widespread location of collaborators makes for a global community. The collaborators don't think of themselves as Americans or Russians, but as scientists working together to discover how the universe is put together. In this age of increasing globalization, this communal, collaborative spirit becomes even more important.

Bonhoeffer advocates working in the world. Scientists do this (and sometimes go above and beyond, working in space.) What could be more of this world than a world-wide collaboration? Scientists on this project, and other collaborations, have decided their responsibility is not to their own interests, their own institution, or even their own country, but to the collective knowledge of humanity. Though dark matter scientists look to the heavens for evidence, they are firmly rooted in the world.

## References

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