Thank you for the invitation to speak and lead this discussion with you this evening. Understanding the practice of science and the practice of religion, what what they might have to say to one another has been one of my favorite topics for a long time. I think that’s in part, because ever since I was 7 years old I’ve wanted to be an astronomer. I’d go outside on clear evening in the Chicago suburbs where I grew up, and use my small K-Mart telescope by parents bought me to find all the objects I could locate in those relatively bright skies. Even now, I love going out on dark Wyoming nights, and enjoying the beauty of the skies we have here....and I wonder the same thing I did when I was 7 years old: What's up there? How does it work? Where does it come from? What does it mean?

I also like participating in dialogs about science & religion because they tend to be about the questions that matter most in today's society. They involve matters like medical ethics (How do we/should we do stem cell research? How do we balance out impressive medical technology with policies that involve end-of-life decisions?) or origins issues (What are human beings? What does it mean to be a “person”? If humans have “rights”, what are they and where do they come from? Where did the universe come from? Where is it headed?). My intent tonight is not to address specific issues in which scientific and religious perspectives are involved. My goal is to help provide a linguistic & philosophical framework...a way of speaking and thinking...which will allows us to

- engage in discussions of these often highly charged issues so that we can make progress in these important areas with our partners in the discussion (If you don't have conversations about important issues with your friends or family, let me encourage you to do so!)
- form a more self-consistent, logically sound basis from which to make our voices heard in the public sphere

Let me begin by characterizing the nature of science and the nature of religion as community oriented enterprises, each with their own sets of rules and rites and rituals. While recognizing that the world's religious traditions are extremely varied and difficult to characterize briefly, I am going to base my description of religion on the world's major theistic faith communities, namely the Judeo-Christian-Islamic tradition, with which the Hindu tradition could also claim much in common.

First however, a parenthetical aside. I want you to notice that “science” and “religion” are not really parallel constructs. Nor are they opposites. Yet, somehow these are the keywords that have come to symbolize an entire way of framing a discourse which is sometimes regarded as a “conflict” or even “warfare”. Speaking of the relationship between science and religion is a little bit like speaking of the relationship between mathematics and pencils...or the relationship between farming and the color blue.

science ⇔ religion

Science (study of mechanisms of the physical world) ⇔ Theology (study of God & transcendent world)

More properly, science should be compared with theology, which is the study of God and the transcendent world. But for the the purposes of this talk, I'll accept that for public discourse, most discussions pit “science” against “religion”, so I'll proceed under this unfortunate and disingenuous association.
Properly understood, both scientific communities and religious communities engage in practices which have far reaching implications for who we are as human beings, but the realm of their authority appears, when carefully examined, to be distinct and limited in scope. Miracles, if they exist, cannot be studied by the methods of science because science functions by looking for repeatable, verifiable events in nature. Similarly, religious texts and traditions (although they may promote virtues such as patience and perseverance which are needed in scientific investigations) do not contain, for instance, the calculus of electrodynamics, or recipes for the covalent bonds in organic molecules. I often wonder, or even wish, what it would be like if God did give us an encyclopedic set of descriptions, saying ‘Yep, and here’s how I did it’. If God did give us such a manual, surely it’s not in some sacred text, perhaps hidden in some code...rather, it’s out here, in the universe, waiting to be read. Galileo, an often maligned and misunderstood figure in the history of the science-religion saga, said that God wrote two books, the ‘book of nature’ and the ‘book of scripture.’

So it may seem at this point that I’m advocating some kind of segregationist approach to science and religion...sort of a “separate but equal” policy. Hang on, I’m not quite there yet. Before turning to discuss ways in which these two audacious enterprises can be related, I need to introduce a couple of other terms to help us understand why the popular portrayals of science-religion dialog in the media are frequently reduced to simplistic caricatures. Caricatures are always unhelpful, and they usually involve some kind of label being assigned to a particular group or viewpoint in an attempt to gain a rhetorical advantage. Be aware of this mistake, whether intentional or not, in your deliberations. Such tools of rhetoric usually go something like:

- Scientists have concluded that ....... (point: scientists are rarely of one opinion or conclusion)
- Fundamentalists believe that ....... (point: labels detract from credibility)
- Creationists disagree with scientists that ..... (point: insinuates scientists can’t be creationists)
- Evolutionists all take the view that.... (point: what is an evolutionist?)

as if all viewpoints can be lumped into one camp or another. Be generous in your conversations with people whom you may disagree, and take the time to understand what may be a complex set of reasoning, making the...
effort to go beyond labels. Other tools of rhetoric (or just habits of sloppy thinking) fail to recognize when issues of philosophy or worldview become conflated with the practice of science. Essentially, there are two fundamental worldviews. Sometimes a worldview is also called a meta-narrative, that is, a high-level, all-encompassing explanation for the totality of existence.

**Naturalism**:
A belief system which recognizes only physical material objects and forces as ontologically ‘real’. A.k.a. atheist or sometimes Scientism. A person who practices in the community of scientists may or may not be a ‘Naturalist’ (with a capital “N”) to avoid confusion with a person who exhibits a love of the outdoors. The latter is a ‘naturalist’.

**Theism**:
A philosophical belief system which recognizes both a physical world and the existence of transcendence (God, angels, heaven, etc.) while ascribing the ground of ultimate being to a Deity. A person who practices in the community of scientists may or may not be a ‘Theist’. (One could, in principle, be religious without being theist, but this is a very limited set of the population.)

Most scientists (and I would argue, any general member of the public), whether they are a confessing Naturalist or Theist (or Agnostic, one who claims to be undecided about the reality of things), practice, on a day-to-day basis, methodological naturalism. That is, in modern society, we all operate (don’t we?) as if the laws of physics (gravity, electromagnetic forces, nuclear forces) are sufficient to describe the world under all ordinary circumstances. We wear our seat belts, we tread carefully on high rooftops, we avoid open flames at gasoline stations....we believe that the sun will rise again on the eastern horizon, not too many hours from now. Even the theists (with a very few exceptions for remaining isolated tribes and cultures) don’t ascribe the actions of rocks falling and fire burning to the capricious actions or gods or spirits. Nature has, what one Christian theologian has called functional integrity. The repeatable, established laws of physics are sufficient to account for the functioning of the physical world under normal circumstances. It is this functional integrity with which God seems to imbue the world in the Genesis account of creation, where it is made clear that the world is not part of God, but a separate creation. Even if God is ultimately sustaining the existence of the universe from moment to moment, and ensuring that physical laws don’t change on a daily basis, it is this functional integrity coupled with the practice of methodological naturalism, which has allowed the discipline of science to construct a pretty good understanding of how the world works.

So to summarize, I’ve argued that a practicing scientist, or anyone who accepts the validity of observation and experiment as a guide to understanding the material world, may self-consistently adopt a philosophical framework which is either Naturalistic or Theistic. I’ve defined both of these as ‘belief systems” implying that consciously adopting one or the other, is, to a large extent, a matter of faith. The choice of either philosophical system may be motivated by personal experience, material evidence and rational argument. But the choice of which one to ultimately adopt requires a ‘leap of faith’. Knock-down, irrefutable proof is a concept no where to be found in science, save perhaps in the realm of pure mathematics. Recent work in mathematics has even shown that the language of mathematics is insufficient to describe itself....even simple mathematical languages contain propositions what must be true but which cannot be demonstrated to be true using the axioms of that mathematical language. (For those that really want to know, this is called Goedel’s Incompleteness Theorem). Both science, and everyday life, I might argue, function on theories. Sometimes people use a rhetorical device to discredit a disagreeable or threatening proposition by saying, ‘But that’s just a theory.” I claim that nearly all of our knowledge falls into the realm of theory. It’s just a theory, for instance, that I’m on the UW campus speaking in front a of a group of college students. However, some theories have more support than others. Support for theories comes from several sources. Support comes from observations (data) which are consistent with the theory. Support also comes from agreement with other more fundamental theories which the new theory helps to further refine or explain. Scientists (and theologians) ascribe a quality to good theories called “fruitfulness” when a theory is able to make predictions about
hitherto unobtained observations or when a theory is able to resolve a long-standing conflict with present theories or data. For instance, Galileo’s theory that the planets including Earth revolved around the sun had fruitfulness because it resolved issues the heliocentric theory could not, or at least it resolved them more cleanly with fewer ad hoc supporting hypotheses. And it led to predictions of planetary motion which could, much later, be confirmed with observation. It wasn’t like Galileo’s theory was instantly provable or accepted. No, it took generations for it to be accepted. But it was more elegant. It was simpler. Ultimately it was more consistent with the data. All those things are characteristic of good theories. I don’t have time to develop these ideas more, but if you are interested in the study of knowledge, things like how and when we are justified in claiming that we KNOW something, then you want to do further reading in the branch of philosophy called **epistemology**, which is the study of the structure and nature of knowledge.

So back to matters of faith in science & religion. Scientists too, work under the (motivated, but still a matter of faith) assumption that physics works the same way at all times and places in the universe. Scientific communities (and some would argue religious communities too) operate by organizing measurements and observations into coherent stories, unified by one or several overarching theories. (I’m drawing here from work by philosophers of science Thomas Kuhn, Imre Lakatos, and Nancy Murphy, among others). In this picture of science and religion, the overarching theory which is required to make sense of all the data is called the ‘hard core’. No, this doesn’t describe scientists who are so into their work that they forget to eat or missionaries who trek across Africa in their bare feet. The ‘hard core’ is the central proposition of a scientific theory or a religious theory (doctrine? hey, is this rhetoric again?) which knits together all the data. It is surrounded/supported by a network of auxiliary hypotheses and data which, taken together, protect the ‘hard core’ from attack/falsification. The ‘hard core’ is extremely resistant to falsification, while any of the auxiliary hypotheses or data can be modified or falsified without endangering the ‘hard core’. This view of the scientific enterprise might represented schematically as below. Measurements and data, the outside of the figure, comprise the raw material for the formation of theories and hypotheses. A network of theories and hypotheses link the observed data with the fundamental proposition: the ‘hard core’.

For example, the conception of the process practiced by scientific and religious communities might look something like the above figure. Examples of how this schematic conceptualization plays out are as follows.
Because the fundamental premises of scientific and religious traditions are wrapped up in a network of data and auxiliary hypotheses, attempts at verification or falsification of the hard core are difficult. For example, the existence of evil in the world no more falsifies God's existence than does the fact that 90% of the universe being composed of some dark, unknown type of matter falsify the picture of the origin of the universe in a giant explosion some 13 billion years ago. Contrast this picture of science/religion enterprise with the picture I suspect many people hold (pictured below): a singular tower of knowledge, built block by block, with the stability of each level requiring the uncompromising truth of the layer beneath.

Patterns for Relating Science & Religion (based on Bube, 1995)

Finally, I’d like to end by outlining several ways of relating science to religion, providing an example from my own discipline, involving questions about the origins of the universe. For millennia, people have either believed that the universe was infinitely old, or that it was created by God or the Gods at some indefinite point in the distant past. Most creation stories from cultures around the world are long on narrative about the role of the, usually multiple gods, and short on details about what most interests our 21st-century minds: How did it
all happen, and when? People were shocked in the 1920’s when Edwin Hubble (for whom the Hubble Space Telescope is named) discovered that the universe is expanding at an amazing rate. People had hitherto supposed that the universe was static and unchanging. This discovery, coupled with Albert Einstein’s work in general relativity, generated a new consensus that the universe seemed to be expanding from a single explosion some billions of years ago. One leading scientist of the 1950’s derisively dubbed this theory ‘the big bang’, expressing contempt for the unpopular notion that there might have been a beginning to the universe. It seemed, to some of these Naturalist-minded folks, just a little too much like the Genesis account of creation for their taste. Nevertheless, that’s the picture we are left with today, after five decades of exploration and observation, refining what we know about the early universe.

So just how does the current picture of **cosmology** (the study of origins) look in light of traditional religious perspectives? The details are enough to fill another lecture, but below are some modes of relating science and religion, using cosmology as an example.

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<tr>
<th>Mode</th>
<th>Description</th>
<th>Critique</th>
<th>Example</th>
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<tbody>
<tr>
<td>1. Science replaces theology</td>
<td>Scientism. Science replaces religious ways of knowing as the guide to all truth. E.g., Carl Sagan, Richard Dawkins, E.O Wilson</td>
<td>Has difficulties providing rules for normative behavior, morality (what is ‘good’?). Can it explain ultimate origins? Inconsistent with experiences of most peoples at most times.</td>
<td>We now can probe to the very earliest stages of the universe, back to fractions of a second after the big bang and explain the resulting universe using the known laws of physics. There is no need to postulate a creator, because there is nothing for a creator to do.</td>
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<td>2. The theology supersedes science</td>
<td>Where science and the bible appear to be in conflict, our science is wrong. Theology, not science is the way to truth. E.g. Henry Morris, ‘Fundamentalists’</td>
<td>Much of modern science, technology &amp; medicine is rejected. Limits God by restricting God to act in ways understandable to pre-historic humans. Interpretational difficulties in scripture.</td>
<td>Origins of the universe and/or humans are not understandable in terms of cause and effect of science; they can only be understood by faith through believing a Biblical account of creation.</td>
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<td>3. Compartmentalism</td>
<td>Science and religion occupy distinct, completely disjoint spheres of thought. No conflict is possible because each addresses different issues. E.g., Karl Barth, Steven Jay Gould, Neo-Orthodoxy</td>
<td>Neglects areas of overlap; takes neither science nor religion seriously regarding issues of origins. Leads to a dualistic view of the world: ‘spiritual’ versus ‘material’.</td>
<td>The origin of the universe and surrounding questions can only be addressed by scientific inquiry. The Bible offers no historical narrative and has no authority on material matters, only timeless spiritual truths.</td>
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<td>4. Natural Theology</td>
<td>Science can provide evidence (proof?) for a creator/designer through evidence in living organisms, cosmology. E.g., Finding a watch in the desert. Hugh Ross, Henry Morris, J.P. Morland</td>
<td>Genesis and science are both treated as historical narratives, leading to interpretational difficulties. May lead to “God of the gaps” problems, i.e, role of God intervening in nature becomes less credible as scientific processes become capable of explaining events.</td>
<td>The existence of both living organisms and the universe as a whole require that many fundamental quantities in nature, such as the speed of light and the mass or charge of an electron, be <strong>finely tuned</strong> in order to allow the observed features of our universe to exist. Such fine tuning requires the action of a creator.</td>
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<td>Mode</td>
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<td>Scientific</td>
<td>Traditional theology must be redefined in light of advances of science. Bible is a book of myths, perhaps with hidden psychological insights. Religion mainly a human construction. E.g., Fritof Capra</td>
<td>Leaves no substantial role for “religion” as traditionally practiced throughout most of history. Similar in many respects to #1.</td>
<td>The ultimate principle behind the origin and forces governing the origin and evolution of the universe is defined as ‘God’. This principle or power may or may not be a personal God as traditionally understood by the world’s theistic faiths.</td>
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<tr>
<td>Theology</td>
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<td>Complementarity</td>
<td>Two different perspectives on the same reality. Both science and religion are authentic sources of knowledge. Nature is God’s general revelation, Bible is God’s special revelation. E.g., Augustine, Francis Bacon, Van Til</td>
<td>Demands highest level of effort at integration and understanding of the appropriate role of scientific and religious knowledge. Allows unresolved tensions at crucial interface issues such as origins.</td>
<td>The astronomical account of the big bang 13 billion years ago is an accurate account of the physical mechanism surrounding the origin of the universe, while the genesis account is an accurate account of the ultimate origin including God’s purposes in creation.</td>
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<td>New Synthesis</td>
<td>A radical transformation of both science and theology into one reality. Denies both the authority of traditional science, as presently understood, and traditional religion. E.g., New Age, some eastern religions, Christian Science, Scientology</td>
<td>Neither scientific investigation nor traditional religious principles offer any guidance toward the truth. Physical world is illusion. All is one. Knowledge is gained only through secret practices &amp; insights. Fatalistic.</td>
<td>What is creation? What is the Bible? What is the universe?</td>
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Do some of these patterns remind you of your own view? Do some of these patterns remind you of family or friends? Are there other possible modes of relation that have been left out of this rubric? Personally, I find #6 to be the most reasonable solution to issues where science and religion seem to overlap. You?

My goal this evening was to outline some characteristics of science and some characteristics of religion. Along the way I’ve introduced some important distinctions between the two which are often overlooked, leading to misunderstanding, and possibly creating an illusion of conflict which does not exist. I hope I’ve also introduced some useful terms that allow you to speak of science and religion and philosophy in more exacting ways. Like any discussion, the dialog becomes more productive when all of the participants speak the same language. I hope I’ve given enough concrete examples that you can take away an appreciation for how these ideas play out in the ongoing public dialogs that involve science and religion. Be bold and be involved in public debates about the role of science and religion and what they have to say about who we are and how we are to live. If the discussions are contentious, that’s ok....it’s because they involve things that matter. Don’t be afraid you’ll hurt feelings. If you respect someone enough to have a discussion, even an argument, with them about things that matter, then it demonstrates you care enough about them to take their viewpoint seriously. Perhaps most importantly, listen more than you speak. May you be knowledgeable and gracious participants in these matters of public debate. Thank you for being here tonight. Let’s initiate some discussion and questions.
Bibliography for Further Reading

*Putting it all Together: Seven Patterns for Relating Science and the Christian Faith*, Richard Bube, (University of America Press, 1995)


*Portraits of Creation*, Howard Van Til, (Eerdmans, 2004)

“What Has Theology to Learn from Scientific Methodology”, Nancey Murphy, in *Science and Theology: Questions at the Interface* edited by Murray Rae, Hilary Regan, and John Stenhouse (Grand Rapids, MI: Eerdmans, 1995).

*Goedel's Incompleteness Theorem*,

*The Structure of Scientific Revolutions*, Thomas Kuhn (University of Chicago, 1970)

Notes and Questions

1) One thing you found interesting in tonight’s talk.

2) One thing you learned.

3) One issue you were confused about.

4) One topic you would like to hear more about.

5) One thing you disagreed with.

I. Can you think of one issue you’ve seen in the news, or one discussion you have had with a friend or a family member where people talked past one another without understanding the other’s position because of confusion about terms or definitions I’ve outlined in this talk? What were they?

II. Do you know people, either public figures or friends or family who hold one of the views regarding the relation between science & religion that I’ve outlined here? Who are they? How does adopting this mode of science-religion interaction shape their view about either science or religion?

Would you enjoy having a regular forum for discussion and debate of these topics with your like minded peers? If so, send me an email at chipk@uwyo.edu and I’ll see if there are enough of us to warrant assembling some kind of reading/discussion group about science & religion.