RELATIVITY: A HISTORICAL PERSPECTIVE

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For a century General Relativity has been pushing us to replace our Newtonian view of a Universe structured by the force of gravity with Einstein's view that it is a spacetime geometry shaped by masses.

To fill a much needed gap in our discussions, I offer three comments drawn from my own historical perspective.

First, be careful what you ask for. We have heard several times that a worthy goal of physics education is to teach students to "think like physicists." That seems to be a version of Henry Higgins' egocentric plaint --- "why can't students be more like us?"

And who is "us"? What does it mean to think like a physicist? David Hestenes has often urged us to make students Newtonian thinkers. That's an aspiration that should make you cringe. After all we have had to invent General Relativity and Quantum Mechanics because Newton was profoundly wrong in two major ways.



And keep in mind that it was "us" Physicists who invented nuclear weapons and missiles to deliver them, and launched the modern national security state with its democracy debilitating secrecy and control.

Service of science to state power is not new. Soon after Galileo built his first telescope, he took it to the Doge of Venice, pointed out its military significance, and got a raise in pay and a better academic position. What most of "us" have been doing for the past hundred years.

To make students any kind of thinkers at all --- Newtonian or post-Newtonian or Einsteinian or Heisenbergian or ethical or moral or principled --- is a Herculean task. I would settle for instilling a general belief in cause and effect, that acts have consequences, that the world does not run by magic, that rescue or destruction does not come from dragons but from the rational pursuit of human ends.

Second, history is a tricky business. Perspectives change with time and circumstance. Just compare the two pictures. Would you expect the young Tolstoy to see the world and its past the same as the old Tolstoy? Historians celebrate the need to rewrite history in every generation. A Kuhnian revolution: The rise of Einsteinian physics Charles H. Holbrow – June 2016 History would be an excellent thing

if only it were true.

Lev Tolstoy quoted by Isaiah Berlin in The Hedgehog and the Fox



That warns you that historical truth is supple at best and elusive at worst, that it is written in service to some end.

Third, we are at a transitional moment. The history of physics is on the cusp of a phase change. As Thomas Kuhn saw, such changes produce changes in perspective that rob us of understanding of the past. Rippling Einsteinian space-time is



We live on the cusp of a phase change in our perception of the world --- from Newtonian to Einsteinian.

Charles H. Holbrow – June 2016

replacing Newtonian dynamics. And we view this change as we view this picture of the old-young woman: we can see one or we can see the other, but we can't see both at once. Our vocabulary reflects this instability. Edwin Taylor wants to exclude Newtonian words from our discourse, but they creep back into the conversation. That's what happens on the boundary of change of phase, one moment liquid another gas.

Characterizing our interactions at this conference as liquid, solid, or gaseous opens a vista for one-liners, but I let those go and close by saying that this has been a rare occasion to share excitement and pleasure of a major change in physics that has been slowly reconfiguring our world view and bringing us into a new state of understanding.