Lab #6 — Astronomy 184L — Life in the Universe
Meteor Crater

Field trip on Sunday, October 4, 2009

Lab due by Thursday, October 15, by 3:00 pm *sharp*

There are four main scientific goals of this lab: (1) Understand the process of crater formation and the power involved; (2) Learn about meteorites and the relationships between meteorites and impact craters; (3) Learn about potential impactors in the Solar System and impact craters elsewhere; and (4) Understand the implications for astrobiology of the above concepts.

The assignment is described below, and is due in my office or my mailbox by 3 pm *sharp* on Thursday, October 15. Make sure that you write complete sentences and paragraphs that have logical flow and complete thoughts. Also, you should always cite your sources. Please ask me if you have questions about this. Please make sure you answer all the parts of all the questions. You must show all your work (for calculations). Otherwise I have no way of evaulating what you did. It helps you to show your work, because you cannot get any partial credit if you don't show your work.

For this assignment, I'd guess you probably would want to turn in something like 2–3 pages, with perhaps a half or whole page for each question.

The assignment

Part 1: Jay Melosh and Ross Beyer (at UA) made a nifty web page:

`http://www.lpl.arizona.edu/tekton/crater.html`

We know certain things about Meteor Crater: The diameter is around 1200 meters, and the target is pretty solid rock. We believe that the impactor was around 50 meters.

Using Jay and Ross' web calculator, make a plot of impact velocity (vertical axis) as a function of impact angle (horizontal axis) that shows the range of solutions that could plausibly have created Meteor Crater. Do this for all plausible impactor densities. You should connect the points for solutions with the same densities, so that you'll end up with curve(s) that show a range of solutions for a given density. You need to justify why the impactor density/densities that you have used is/are plausible! In all cases you can use values from their pull-down menus (except for impact angle, of course) – don't worry about trying to guess your own densities or impact velocities.

Part 2: If an asteroid or comet around 50 meters in diameter (the size of the body that created Meteor Crater) were known to be heading toward Earth on a collision course, what, if anything, would you think should be done? What if an object 500 meters across were going to hit Earth – does your answer change? You can use the web page given in question 1 to calculate the energy difference between these two impactors. For your information, the nuclear bombs dropped on Japan in 1945 were around 20 kilotons (explosive yield). Do some web research. What plans/ideas/thoughts are out there to ameliorate or eliminate possible impacts?

Part 3: How would impacts be considered "good" for the origin/evolution of life? How would impacts be considered "bad" for the origin/evolution of life? Discuss.