1 WHAT IS THIS?

This document is a collection of notes, emails, and other odds and ends that describe the Project Astro activities I used for 6th grade students. The main goal was to have this written down someplace so next year I would have a starting point.

However, I've was asked to make this 'usable' by others, so I've attempted to add a little order to it all. Unfortunately, this document had its genesis in a list of things to watch out for, so it tends to talk about problems more than the accomplishments that we had. What was achieved far outweighed the problems, and from the student's perspective, I doubt they were even aware that there were 'problems.'

1.1 PEOPLE

Cathy is Cathy Clemens, the Boston Area Project Astro coordinator. Rob is Rob Estes, the 6th grade teacher at J. G. Whittier Middle School that is my Project Astro partner. Judy is Judy Dierauer, the other science teacher in the 'team' of 4 teachers that has the same group of kids (there are two 6th grade teams at Whittier). Rob teaches 2 science classes a day, I was involved with one of those (except for 2 larger activities that involved Judy's classes as well).

2 SUMMARY OF PROBLEMS BIG AND SMALL

45 minute class periods are too short to do anything useful when doing hands-on type activities.

Rob was able to work out an arrangement with the other teachers to get double class periods during my visits.

29 students in a class is too many to work with

Not much to be said - had to stick to activities that didn't need lots of interaction with the students. A related issue was that 2/3 of the class were boys, and it was tough to get the other 1/3 involved - though when they did the girls consistently asked better questions.

Sticking to a schedule can be tough (for the teacher)

Some activities required repeated outside observations prior to visits, but didn't go as planned due to delays in getting the class up to certain milestones. My visit dates couldn't be readily changed to work around those type of delays. I suspect that next year we can develop some contingency plans.

More prep time was needed

Being able to dry run more things with Rob would have helped, but realistically there is just not enough time available to do that. We'll just treat year 1 as the dry run.

Kept trying to cram too much into a class period

Got better at this as we went along.

No slide projectors were available.

I borrowed one from work, the school is making an effort to purchase one for next year.

No video projection system for connecting to a PC.

I had hoped to use a PC to show off 'current' images, animations, etc. Ended up printing out color overheads, which actually worked out reasonably well, as it eliminated all the things that go wrong with PCs when you need them to really work.

Would have been helpful to have them know scientific notation at this point

Having them learn that in math would have been nice, as they could see the application. However, since it was early in the year, the math stuff was still doing a review of prior stuff. This never became a real problem.

Had to keep remembering to ask questions, keep the students involved, and not talk too much

Working with 6th graders is different than working with adults. How anyone can do it for 180+ (?) days a year and maintain sanity is a mystery to me. Enough said.

3 OUTLINE OF ACTIVITIES

Exercises were either from *Universe at Your Fingertips*, *Earth, Sun, and Moo*n, or *Moons of Jupiter.*

3.1 TIME SPENT OUTSIDE OF CLASS

- Two meetings with Rob and Judy prior to my first visit, about 3 hours each.
- Answering questions from the class via email: about 3 hours total.
- Prep time for each visit was about 1 hour, except for the 4 classes combined comet/Jupiter activity, which was about 4-6 hours, mainly getting CO2 and practicing making comets.

3.2 THE VISITS

3.2.1 3-Sep-98:

Initial visit, *Picture an Astronomer* exercise.
See "First day impressions" (Section 8) for details of visit
Exercise C-1 (earth shape & gravity) - ran out of time (45 min), so only had them fill in worksheet
Also see Section 4 and Section 9 for related materials.

3.2.2 8-Sep-98:

Presented slides relating to gravity (see handout and notes in Section 10) - wasn't sure about doing this, but it worked in that I found myself coming back to the this and the critical thinking handout.
Did follow-up to exercise C-1 (earth shape & gravity), but ran out of time (45 min) again because the first part took a bit longer than planned.

Also see Section 4.

3.2.3 1-Oct-98:

Moon phase exercise from Earth, Sun, and Moon book (light bulb and balls). I think maybe we should have used a low wattage bulb.
Did a double period (1.5 hours) so we didn't run out of time.
Peter Bealo (ATMoB member and on the Project Astro board) and Joe Bergeron (friend of Peter's, professional artist, see http://www.members.aol.com/jbergeron) assisted. Having Joe there was great, as the students liked to see that an artist could be into 'science.'
Added the "what's wrong with this picture" exercise at end - using two pictures of sunrise/moon-rise from a Barney book that are impossible to have happen.
Class was supposed to have finished observing moon phases and charting results prior to this visit, but weather/scheduling problems interfered. I think not having them observe prior to the inside part cut the effectiveness a bit.

3.2.4 8-Oct-98:

The BIG SHOW...kids, don't do this at home.
4 classes (120 students) in the auditorium for 2 hours:

Presentations by Cathy (slides about projects she had worked on, very nice comparison of the various telescopes, comet back-ground) and Brewster (comets, asteroids, Jupiter, SL/9).

Make a comet exercise from UAYF (Cathy at one end of the room, me at the other, each with 60 kids).

Moons of Jupiter exercise. Cathy managed that one as I burned out...I spent some time going table to table, I would say that most of the students were following it.

The kids really liked it, but it was too much in that in retrospect I think I would have rather put the effort into the one class that I was working with. Then again, having done it once, might not be so tough the second time around.

I think having Cathy there as the 'professional' astronomer made a huge (positive) impact.

We had press there - needed to have a release written up ahead of time

3.2.5 28-Oct-98:

1000 yard model of solar system.

Had 2 hours (did during lunch, kids brought lunch to eat at Pluto). Did with 2 classes (one of Rob's and one of Judy's) together (60 kids).

Only thing I would change would be to use physical objects for the

planets instead of circles on paper - the relative planet sizes didn't sink in. Maybe even do the planet sizes inside BEFORE doing the outside exercises.

Once outside, difficult to communicate with 60 kids at once. The bullhorn helped, but made it a bit like we were always shouting at the kids.

Added in an extra: The goal was to 'do lunch' on each planet, but each time we spread out the picnic blanket something goes wrong' (Mercury - it burns up (well of course there's no oxygen); Venus - we get eaten by acid, crushed, heated; Mars - we're on the wrong side of Olympus Mons, but it's too big to walk around; Jupiter - the blanket just sinks; Saturn too windy) Maybe work that in more with the students next year.

3.2.6 Nov 19 star party

This date was rained out, but the 24th worked out - though it was raining when we started the slide show, it ended in time to set up and observe. See the star party notes for all of the setup issues. This event worked out fine, and can be redone "as-is" next year. Both ATMoB and NSAAC volunteers helped out. The star party was done 6th grade wide.

See Section 11.

3.2.7 Nov - Museum of Science visit

Issues at work prevented me from attending this, but it worked out as a good conclusion to the astronomy section.

4 VISIT 1 & 2 PLAN NOTES

These are some rough notes made prior to the first two visits.

View results from 'Picture an Astronomer activity'
See what the questions are and answer them (short answers...)
Try to work in the following:

Amateur vs. professional astronomer.
    Nature is interesting (not just astronomy)
Some 'professional' activities done by amateurs:
    Variable star observing
    Occulations of stars
    Comet finding
    Supernova finding
    Mars, Jupiter, Saturn weather observations.

why be interested in it?
    M. Seeds: "We live in a very big universe described by a small set of rules; that those

rules are knowable; that the human race has found a way to figure out the rules"
But originally stated by Thales of Miletus (624-547 BC, what is now Turkey).
"Mysteries are mysteries because the are unknown, not that they are unknowable."

BWL (paraphrasing others, mainly Carl Sagan): "We are made of star stuff - except for the hydrogen, everything that makes us what we are came from some long ago supernova. It's the ultimate answer to HOW you [we] got here."

Fantastic things out there:
great attractor in Centaurus 600km/sec = 375 mi/sec (40 million lt years away)
Black holes with masses of millions of suns
Gamma ray bursts that emit more energy than the entire universe

Fantastic questions:
Neutrinos have mass? Every second, trillions of them go through you
Dark matter - 90% of univ. is missing?
Open or closed universe?

Science vs engineering.
if some of their parents are engineers...
Science if the process by which intelligence tries to understand the universe.
Engineering and technology is the adaptation of scientific understanding for practical purposes.

Scientific methods (from M. Seeds, Foundations of Astronomy)
Plato (428-347 BC) Aristotle (384-322 BC) - 'natural philosophers' (Ionian)
Basically, sit around and come up with ideas...'perfect circles'
Ptolemy c. AD140 - circles w/ circles to make better predictions
(dark ages in western culture)
Copernicus (1473-1543); Sun @ center ('cause Ptolemy's system poor predictor)
Galileo (1564 - 1642): Small telescope - big brain - proved Copernicus was right - ushered in a new era of science. St. Augustine "Credo ut intelligame"- Believe to understand: Galileo (&contemporaries) "The Bible tells us how to go to heaven, not how the heavens go"
Feb 1632: Dialogue concerning the Two Chief World systems - got him in trouble with the pope 'cause he had been told not to believe in copernicus. "E pur si muove" - Still it moves @ Inquisition
Did experiments with falling bodies (but not @ Pisa) - acceleration, learned that it is constant (contradicts Aristotle) regardless of mass.

Tycho (1546-1601) - Observation (had fixed earth but other planets around sun)
Kepler (1571- 1630) 3 laws of planetary motion (1609, 1619)
Newton (1642 or 1643 depending on the calander - 1727) - Da' man...

Need to mention other cultures, particularly Islamic ones contributed lots of observations. Mayans/ venus. But the written records are of western science.

5 HOW MANY STARS EXPERIMENT

Did not get to do this in 1998, but definitely would like to work it in sometime.

See PARN: activity H-3, page 26 - same basic idea as that, except use salt and measure things in boxes (round type) of salt (using cc. is too 'confusing'). I read this version somewhere, but couldn't find it, so I recreated it as best as I could remember.

stuff needed

4 ? cartons salt
measuring spoon set
measuring cup
smallest measuring spoon possible
sheets of black paper to make it easier to count (have students cut them up)

ask question:

If each grain is a star, How much salt is needed for milkyway? Don't say how many stars there are unless kids ask or have already covered that previously (which will be the case for us?). (use 200 billion).
Show them how small a grain is.
measure out a teaspoon, table spoon, cup, ask people to lower their hands when they think I've hit the # - each student should write it down.
When last hand down, ask some of them what they picked and why.

Do exercise:

divide into teams, pass out the grains.
get each groups count, put #'s on the board, have class calculate the average
if they haven't asked yet, NOW say 200 billion stars, and ask each group how much salt is needed. put it into how full the room would be

Make sure:

They understand that this is a MODEL!!!

If $200x10^9$, and 500K grains in box, then need 400,000 containers. if 4 containers per ft^3, then 100K ft^3 needed. if room is 30x50 (1500 ft^2), then need to stack them 66 high (or fill 6 class rooms).

Discussion.

if you visited each star for 1 second, how long to visit them all? 6,400 years
200 billion pennies stacked would be 286,000 km (179,000 miles).
avg galaxy is probably 100 billion stars, and visible universe has 100 billion galaxies
diam of sun = $1.4 x10^6$ km = 875,000 miles. If 1 grain of salt is .015 inch (=.38 mm = 3.8×10^{-7} km) - based on a '.' on a computer monitor at 72 dpi, then the scale factor is $1.4 x10^6 / 3.8 \times 10^{-7} = 3.7 x10^{12}$
or round it off to 4 trillion times smaller than real life.
distance to alpha centuari = 4.3 ly = $2.5 x10^{13}$ miles or $4 x10^{13}$ km

so at this scale 4 x10^{13} km / 3.7 x10^{12} = 11 km or 6.8 miles to the next grain of salt...

6 BACKUP ACTIVITIES

Never ended up using these.

6.1 ASTRO IN THE MARKETPLACE

PARN: activity M-3, page 16

Can be done/finished outside of class.

6.2 WHO WAS RIGHT

PARN: activity M-1, page 4

Colombus/distance to China. Need to make handouts (3 pages) for everyone. Need to cover size of earth previously?

Probably takes 1/2 hour?

6.3 TRIP TO THE MOON

PARN: activity I-3, page 24
The old ‘crashed on the moon’ group dynamics exercise, turned around a bit. Need copies of hand-outs.

7 THINGS TO REMEMBER...

Kept these on hand just in case I got asked a question and needed to convert units in my head.

Conversions:

1AU = 93 M miles = 150 M km = 8 light minutes
1 light year = 63,240 AU = 5.9 $x10^{12}$ miles = 9.4 $x10^{12}$ km
1 parsec = 206,000AU =1.9 $x10^{13}$ miles = 3 $x10^{13}$ km = 3.26 light years

1lb = .45 kg 1kg = 2.2lbs (@ earth surface)
1mile = 1.6 km 1km = .6214 mi

1 Joule = 1N for 1meter (or an apple falling off of a table) = .7376 ft-lbs
1 HP = 745.7 joules/sec
1 watt = 1 joule/sec

Constants:
c = 300,000 km/sec
M_{earth} = 6 x 10^{24} kg = 13. x 10^{24} lbs
R_{earth} = 6378 km = 3963 mi Diam = 7926 mi, circ = 24900 mi
M_{sun} = 2 x 10^{30} kg = 4.4 x 10^{30} lbs
R_{sun} = 700,000 km = 437,500 mi Diam = 875,000 mi, circ = 2.7 M mi
L_{sun} = 3.8 x 10^{26} J/sec
M_{moon} = 7.3x 10^{22} kg
R_{moon} = 1738 km = 1086 miles

planets - see sep sheet.

magnitude scale
sun -26, moon -12, venus -5

Table 1: Magnitude

mag	scale factor	example
0	1	sirius, -1
1	2.5	
2	6.3	(polaris)
3	16	
4	40	
5	100	
6	250	(naked eye)
7	630	

Table 1: Magnitude

mag	scale factor	example
8	1600	
9	4000	
10	10000	
15	1M	
20	100M	
25	10G	(hubble)

8 THOUGHTS FROM THE FIRST DAY

This was the first class period of the day, 8:45 to 9:30. 45 minutes is VERY short. Stay away from the first class period because there are all sorts of interruptions (particularly since it was only the 3rd day of school).

One the first day of school Rob did the *Picture an Astronomer* exercise. Each student also came up with 1 or 2 questions, which Rob transcribed onto index cards along with the students name. I arrived at 8:30 and he handed me the cards so I could think about some answers (or which ones I wanted to answer first, as I only had about 10 minutes).

I thought I could safely hide in the back before class started, but as luck would have it the flag was in the back of the room, and I ended up being in the front for the pledge of allegiance, which the last time I said it was probably 15 years ago. Need to practice that one...

I had planned on bringing some slides, but didn't get them before now, so instead I downloaded about 8 pictures from the net and made overheads. I choose x-ray view of the sun (Yohkoh) and the TRACE magnetic connection event from the spring - at the projected scale the earth was about the size of a quarter. With the both pictures I asked the class what they thought they were pictures of, it took a while to get the right answer. The other pictures were hubble shots of some galaxies (Cartwheel and NGC4313) and planetary nebula (M2-9, and a 'gallery' of 6 pictures). I think the sun ones were the best understood by the students.

I may try showing a few pictures each visit as a segue between parts.

The exercise:Picture an Astronomer:

The only in class part I was there for was the questions. Rob gave me the sheets that the kids handed in, about 20% of them confused astronomer with astronaut - but Rob was purposely vague when he did the exercise. The answers/pictures are pretty amusing! I also noticed that the girl's questions were much better than the boys, but they were much more reluctant to raise their hands in class. I spoke with Rob after the class about ways we can make sure it stays more balanced (one problem is there are twice as many boys in the class as girls).

In class:

We did the C-1 (earth shape & gravity), which has 4 questions. We only had time to have the students individually fill out the worksheets (took about 5 minutes once they were handed out). I'll be going back on Tuesday to do the group part and the discussion.

Rob still has to tally the results, but I would estimate that on the 1st question (shape), there were 2 “round, but we live on the flat part”, about 10 “round like a record”, and the rest correct (27 kids total?).

No one got the last one (drop a ball over a hole through the earth) - but I'm pretty sure that some of the kids misunderstood the question. It would have been nice to have a model to explain the question with, but that would defeat the 1st part of the exercise.

Stupid last minute questions:

What to call the teacher in front of the students.

What to wear - I tend to dress in jeans for work, but the (male) teachers there tend to wear shirt/tie.

9 THOUGHT HANDOUT

WHY IS THAT?

Some thoughts about science and critical thinking

A. Einstein:
Unthinking respect for authority is the greatest enemy of truth.

Michael Seeds (Astronomer, Author):
We live in a very big universe described by a small set of rules; ... those rules are knowable; ...[and] the human race has found a way to figure out the rules.

Originally stated by Thales of Miletus (624-547 BC, what is now Turkey):
Mysteries are mysteries because they are unknown, not that they are unknowable.

Science is the process by which intelligence tries to understand the universe.

Engineering and technology is the adaptation of scientific understanding for practical purposes.

Scientific method:

Theories must make predictions to be useful!

Hypothesis: Assertion or conjecture to be tested.

Theory: System of rules and principles that can be applied to a wide range of circumstances.

Natural Law: A theory that almost everyone accepts as true.

My own summary (paraphrasing others, mainly Carl Sagan):

We are made of star stuff - except for the hydrogen, everything that makes us what we are came from some long ago supernova. It's the ultimate answer to HOW you [we] got here.

10 GRAVITY HANDOUT

The ultimate force in the universe: Some thoughts about gravity.

Four known forces:

Electromagnetism: James Clerk Maxwell (1831-1879) realized that electricity and magnetism were related and could be described by one set of equations. (light, chemical action also explained here)

Weak force: Involved in radioactive decay (nucleus of atoms). 1960's theory combined the weak and electromagnetism into the electroweak theory.

Strong force: Holds the nucleus of atoms together.

Gravity: Operates at great distances.

Gravity through the ages

Aristotle: Earth, water, fire, air. Earth and water fall 'down' to the center of the cosmos (geocentric or earth centered universe). The more earth or water in the object, the faster it is attracted to the center.
Galileo: Did experiments that showed the mass of an object doesn't affect how fast it falls.
Newton: Developed the 3 basic laws of motion, and equation for gravity:

$$F = \frac{-G \times M \times m}{\mathbf{r} \times \mathbf{r}}$$

Force is equal to a constant (G) times the masses of the two objects (M and m) divided by the distance squared (r x r).

Why do astronomers care about gravity?

Determines the fate of the universe (expand forever, or contract back in a '"big crunch").
Responsible for formation of stars and solar systems (including our own about 5 billion years ago).
Determines the fate of stars when they die (white dwarfs, neutron star, or black hole).
Holds galaxies together.
Determines orbits of objects around each other.

10.1 NOTES ON THE GRAVITY HANDOUT

This lesson was done after the Earth's shape one, which starts them thinking about gravity.

The prior page was copied and handout prior to showing some slides. The concepts are definitely "advanced." The point was to show that there are answers to things, and that it takes time to learn them, but they are learnable. The real point of this was to lay the basis for talking about critical thinking and the scientific method. For example, the equation for gravity is there not that they'll necessarily understand it, but to show that an equation can be written to describe it, and that that equation has worked every time someone has developed a test for it.

10.2 SLIDE LIST

Slides listed as #-# are from the Malin set from ASP, ones listed as GT# are from the Grand Tour set from the ASP.

Stars being born (because of gravity):

1-13 Orion Nebula

GT-21 Close-up showing protoplanetary disks forking under the influence of gravity

4-59 Bok globules ('cause the name sounds cool...)

Stars living (because of gravity):

GT-19 Our sun

GT-? Saturn - planets formed from same basic force

Stars die (because of gravity):

GT-24 Eta Carnie

1-12 Helix nebula

GT-26 Crab Nebula/neutron star

(blank) A black hole...

How Galaxies end up because of gravity

1-1 Centaurus A

1-2 M83

2-28 M87 (about 2.7 trillion stars)

GT-32 M87 center - black hole

11 STAR PARTY PLANNING

These are from someemails to Rob, I've saved them for next year, but they could be used for planning your own events.

Basics

Open to all 6th graders - may want to invite other teachers in the school as well?

Start time: 6:45 arrival time for the parents/kids. (also gives time for people to get from work to Haverhill to setup scopes, etc.). Observing from 7 to 8:30.

Format: two 45 minute sessions, 1/2 in auditorium for lecture, other 1/2 outside, then switch. Start first observing at 7:00

Things needed by the school:

Way to shut off ALL lights in the back area. (Is there a night custodian?) Someone to open/close the school, keep kids in correct areas, etc. Some scope owners may need 110 VAC power - are extension cords and plugs accessible in the back? Also, a few small tables may be needed outside.

Cider and hot chocolate is a nice plus (PTA or whatever has helped with this aspect at other places). Most of the astronomers will have come straight from work, so a light snack for them ahead of time is a major plus.

Overhead projector, slide projector, way to operate lights in auditorium - maybe a microphone if the crowds are large?

A way to let kids know whether the event is on or not (due to weather). Is there a # with an answering machine that parents could call?

Letter home to parents 3-4 weeks before the event (see below).

Make sure the school's event liability coverage is OK for a thing like this - the club in no way will be responsible for anything...

Invite press (and have a press release with all basic info written up ahead of time).

Make sure nothing else is going on at the school those nights.

---------- Letter to parents:

Explain what the event is about, give dates, times, how to check if event has been called off. Warn them that new england weather is not conducive to astronomy, so don't be disappointed if it is called off.

Things to point out in the letter -

1) NO FLASHLIGHTS!!!!

2) where to park (and not to drive w/ headlights on near the observing area if applicable).

3) Siblings are OK, but a child younger than 6 or so probably won't be able to look into a scope and see anything (they don't seem to be able to control their eyes that well).

4) Parents will be responsible for keeping there kids in line, but if they don't, the teachers will escort them to the door. This is particularly an issue in terms of horseplay around the scopes (sometimes the lines get long, the kids get bored, etc.)

5) Just because just about every parent will ask this:

> we're all amateur astronomers, not professionals.
> some of us have made our own scopes, others have purchased them.
> some of the home made scopes represent over two hundred hours of work,
> the purchased scopes you will see at the star party range in price from $500 to $5000, typically.

6) Dress appropriately. It will be November. You will be standing outside for 45 minutes. Standing still even in 40 degree weather on a clear night requires a hat, heavy jacket, warm pants, and footwear with heavy soles (to insulate you from the ground). In November, it's not out of the question to have it be 10 or 20 at night. Bring an extra sweater, scarf, gloves, etc. Most of the astronomers will have snow pants or thermal underwear on - trust us - we do it for a reason.

7) Oh, and NO FLASHLIGHTS (just in case #1 wasn't clear). If you're that afraid of the dark don't come...

Other logistics:
The astronomers will arrive around 6:30. If possible, we would like to park close to where we'll be setting up so we don't have to lug equipment all over the place. There will be people from 2 clubs, ATMoB and NSAAC present, as well as some that aren't in either.

Most of the astronomers will stay past the official end of the event as there are always a few that want to see more. Figure the last person will leave around 9:00.

The teachers are counted on for crowd control. But also make sure you've worked out a plan so that the teachers get to observe as well. Depending on the crowds, they may need to politely cut into the line - otherwise they may not get a chance (unless you have enough that they’re only on crowd control for 1/2 the event). Also, if there is a night custodial staff, make sure they get out and take a look (sometimes you have to twist their arms a bit) - you will find the custodial staff much more fun to work with at future events if you do this (and less likely to complain about the spilled hot chocolate...)

Have a spare overhead and/or slide projector on hand, just in case Murphy strikes.

We will probably come up with some handouts for the event (star chart, background info), so copies will be needed (keep it to 1 per family).

If possible try and get an idea how many kids/parents, etc., will be showing up.

11.1 THE LETTER (EMAIL) TO THE ASTRONOMERS

I’ve taken out the phone #s, the real email had everyone’s #s as well.

```
Hi all,

Here's some more info on the Haverhill star party. Feel free to make suggestions,
corrections, etc.
```

Background:
==========
Event for 6th grade (7 classes). 4 of the classes are just finishing up 8 weeks on astronomy. I have been working with one class as part of Project Astro (see http://www.aspsky.org).

Contact info:
=============
Brewster LaMacchia (ATMoB/NSAAC) (w) 781 937 6300 x 312
bwl@jovian.com

Rob Estes (school contact) (h) xxx xxx-xxxx
rocketest@aol.com

School #: xxx xxx-xxxx

Others that I have contacted to help out:
===
Peter Bealo pbealo@mediaone.net
Kevel McCarthy sigma@mediaone.net
Marion Hochuli MHochuli@aol.com
Tony Costanzo kd1sl@ix.netcom.com
Mario Motta mmotta@massmed.org
Charlie McDonald
Barrie Sawyer SAWYER@osi.sylvania.com (NSAAC contact)

I know that some of you may have conflicts, I've simply using the above to keep track of who I've spoken with.

Date:
=====
Thurs Nov 19th, rain/cloud Tues Nov 24th. Please let me know the best # to reach you at in case we have to reschedule due to weather.

How to get to J.G. Whittier school:
---
1) Get on 495, heading towards Haverhill
2) Take exit 51A (Route 125 South)
3) (if coming via 495 N):The exit bears to the right (you can't turn left), continue straight to a set of lights. from 495 S head south on 125.
4) Go through the lights, get in the left lane. Very shortly after the lights, take your first left (There's a Laundromat on the corner). This is Marsh Ave.
5) Continue on Marsh Ave up the hill until you get to a stop sign.
6) Bear left at the stop sign heading down the hill.
7) Take your second right (go past Passaconaway), turn right onto Concord St. Concord St across from a nursing home.
8) Go 3/10ths of a mile, the school is on the right. Turn into parking lot to the right of the school.

There is a field behind the school - a driveway in the back left corner of the parking lot leads around to an area (between the two wings of the school) where you can park next to the field. The auditorium is in the front of the building.

The field has good visibility in all directions.

Schedule:
========
6:45 to 7:00 PM : introduction, overview, etc. split into two groups
7:00 to 7:45 PM : group 1 gets slide show, group 2 outside
7:45 to 8:30 PM : group 2 outside, group 1 inside for slide show

Targets:
========
Feel free to target anything you like. Here's a few possibilities, just try and make sure everyone has seen Saturn and Jupiter.
Moon will be new around the 19th. Jupiter, Saturn will be easy targets. Uranus will be low and sets at 9:30 (Neptune sets at 8:30). M31 will be overhead. Other targets to consider are the double cluster in Perseus (NGC 869/884), globular clusters M2 or M15, planetary nebula (NGC 7662, the Blue Snowball is one of my favorites and well placed.)

Misc.

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I'll be preparing a handout for the students prior to the event and will also email you a
copy as well. It will include the following:
   o Star chart
   o Basic facts about Jupiter and Saturn
   o Brief descriptions of the differences between an open cluster,
          globular cluster, and galaxy
        o Saturn and Jupiter moon positions
        o Contact info for the two clubs

I'll be practicing my 'anti-rain cloud' dance for the next few weeks...

Thanks for your support.
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