Afterschool Astronomy:

Bringing the Universe into the Community

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Modeling the Universe

- ★ Form teams at your table
- ★ Pick a recorder and a spokesperson
- ★ Using the art supplies at your table, draw a picture of what you envision when you hear the words "**Our Universe**"

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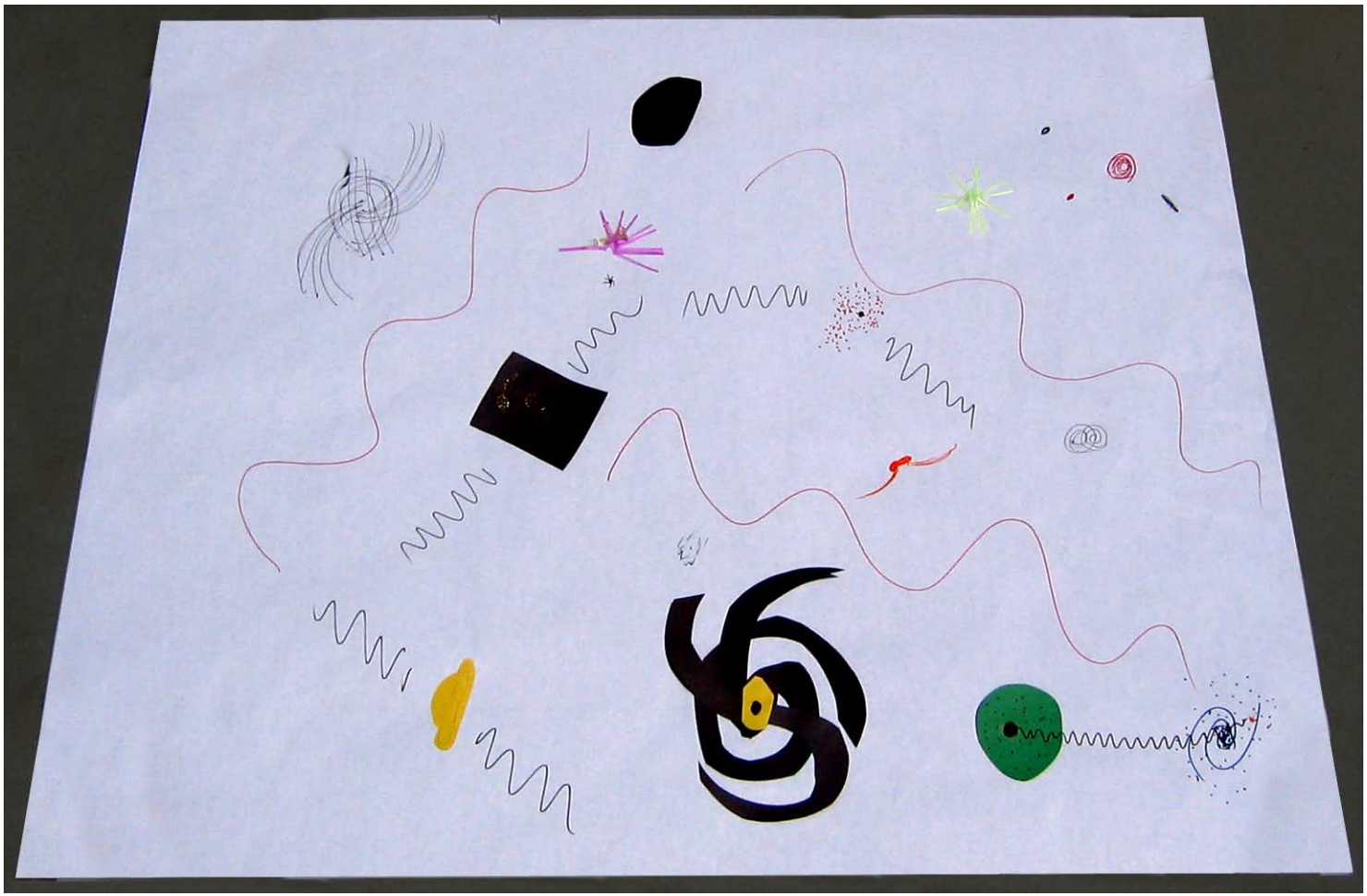

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Our Philosophy

★Why astronomy?

★Why middle school?

★Why out-of-school time?

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Supply vs. Demand

- ★ Students show lots of interest in astronomy topics!
- ★ Programs are interested in academic enrichment!
- ★ So where can you find afterschool astronomy content, ready for you to implement?

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Supply vs. Demand

We couldn’t find an afterschool astronomy curriculum that met our needs…

…so we created our own!

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What is Afterschool Universe?

- ★ An astronomy program for middle-schoolers in out-of-school-time
- ★ Explores the Universe ***beyond*** our solar system and how we study it
- ★ Inspired by an MIT program targeting urban youth in Boston

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Curriculum Development

- ★ Most activities adapted from existing well-tested formal education material
- ★ Consulted with afterschool programs during development
- ★ Pilot tested for 2 years to ensure we got it right – disseminated for 2 more!

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Structure

- ★ 12-session curriculum (45-60 minutes each)
- ★ Flexible implementation to suit your schedule:
  - ✦ Every hour for 2 days
  - ✦ Every day for 2 weeks
  - ✦ Once a week for 12 weeks
  - ✦ Split into blocks of modules
- ★ Students not required to attend all sessions to understand and benefit from program content
- ★ No preliminary science knowledge required for program leader – we'll give you the background!

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Structure

- ★ **Very hands-on** – all activities in the real world
- ★ **Interdisciplinary** – uses many different techniques to reach different types of learners: art, kinesthetic activities, writing, and more
- ★ **Dynamic** – we keep up with refinements and wish to add more modules in coming years

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Topics Covered

I. Modeling the Universe
II. Cosmic Survey
III. Astronomers' Tools – Telescope
IV. Invisible Light
V. Astronomers' Tools – Spectroscopes
VI. Life Cycles of Stars (1)
VII. Life Cycles of Stars (2)
VIII. Our Cosmic Connection to the Elements
IX. Galaxies
X. Black Holes
XI. Visit by a (space) scientist or engineer + Making a Cosmic Quilt
XII. Modeling the Universe – The Sequel

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The Progression of the Program

- Two introductory sessions to start the students thinking:
  - "Modeling the Universe" draws out mental models participants have at the beginning and end of the program.
  - "Cosmic Survey" addresses size/scale/distances.

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The Progression of the Program

- Three tools sessions to discuss discuss how astronomers use light to gather data:
  - "Telescopes" allows the students to construct a simple telescope.
  - "Invisible Light" discusses the light that we cannot see with our eyes.
  - "Spectroscopes" allows the students to construct a spectroscope with paper towel tubes.

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The Tools of Astronomy

What is an astronomer's most important tool?

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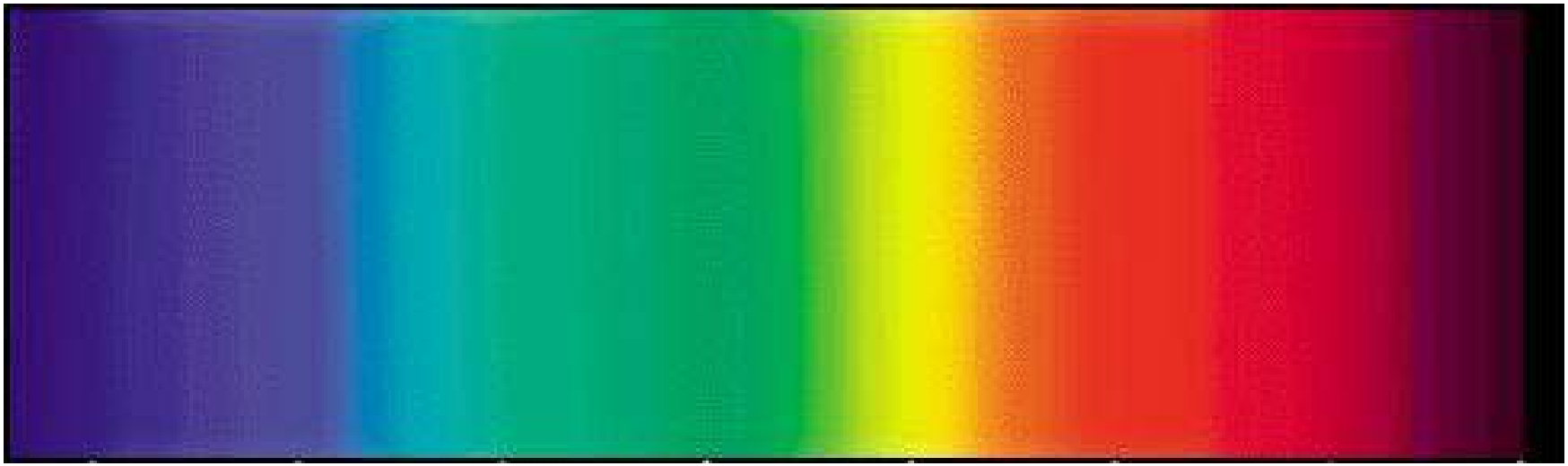
The Spectrum



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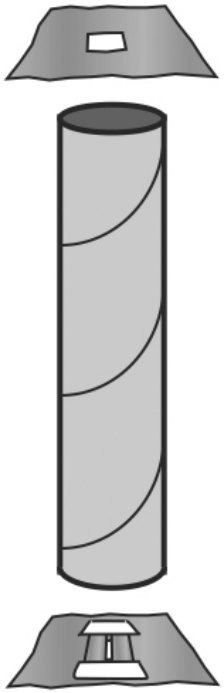
Spectroscopes



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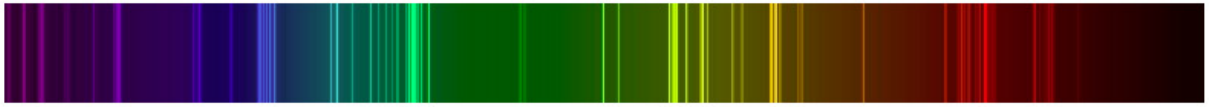
Hydrogen

Helium

Carbon

Nitrogen



Oxygen

The Progression of the Program

- Five sessions discuss components of the Universe and how they fit together:
  - "Life Cycles of Stars" (two sessions) explores what makes stars shine and how they live out their lives.
  - "Our Cosmic Connection to the Elements" discusses the origins of the chemical elements in space.
  - "Galaxies" allows students to model our own Milky Way Galaxy and figure out our place in the Universe.
  - "Black Holes" busts myths about these mysterious and fascinating objects.

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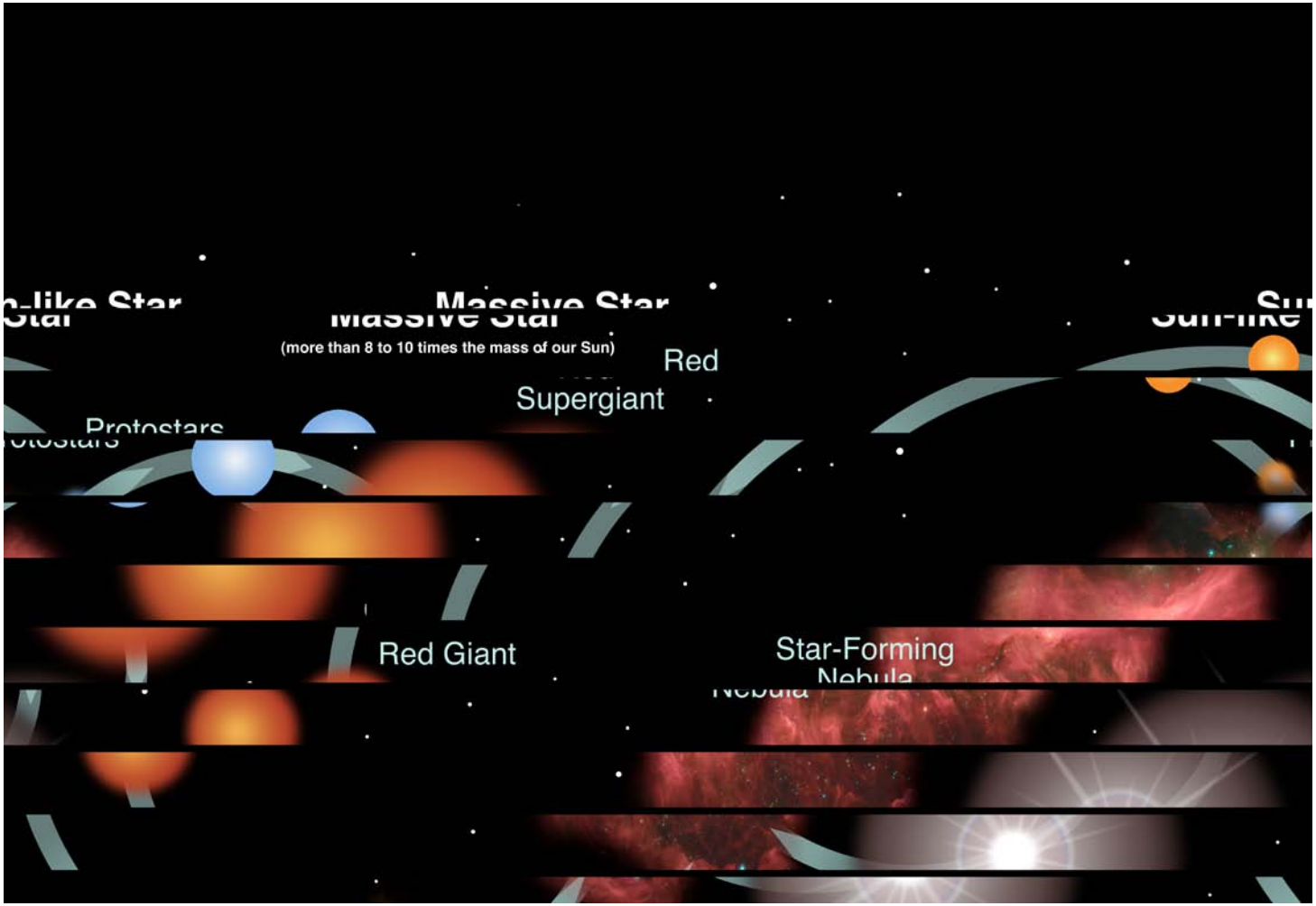

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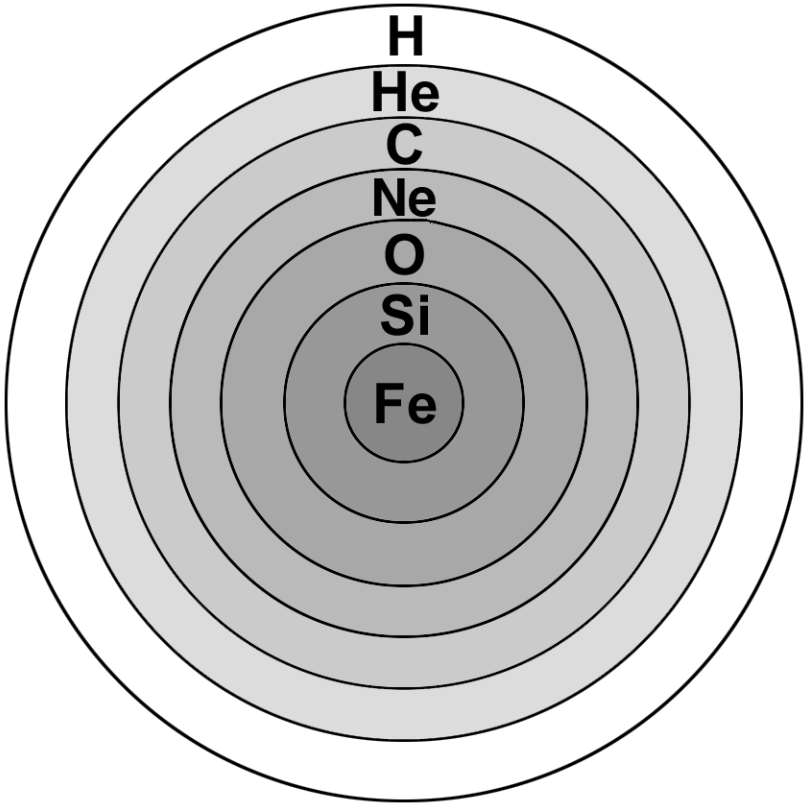
Where do Elements Come From?



PERIODIC TABLE

Atomic Properties of the Elements

Solids
Liquids
Gases
Artificially Prepared

Period																		
1	1 H Hydrogen																	2 He Helium
2	3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
3	11 Na Sodium	12 Mg Magnesium											13 Al Aluminum	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
4	19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
5	37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
6	55 Cs Cesium	56 Ba Barium		72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
7	87 Fr Francium	88 Ra Radium		104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Uun Ununnilium	111 Uuu Unununium	112 Uub Ununbium		114 Uuq Ununquadium		116 Uuh Ununhexium		
Lanthanides				57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
Actinides				89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium

Atomic Number
Symbol
Name
58 Ce Cerium

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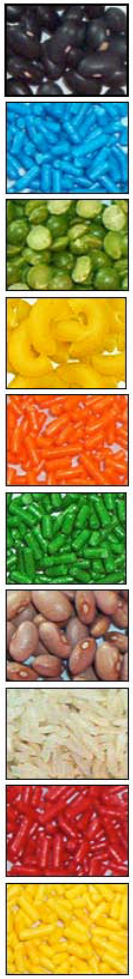
Universe Trail Mix



Black Beans = Oxygen (O)

Blue Sprinkles = Magnesium (Mg)

Green Split Peas = Helium (He)

Macaroni = Carbon (C)

Orange Sprinkles = Silicon (Si)

Green Sprinkles = Neon (Ne)

Pink Beans = Nitrogen (N)

Rice = Hydrogen (H)

Red Sprinkles = Iron (Fe)

Yellow Sprinkles = Sulfur (S)

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The Progression of the Program

★ Scientist/Engineer visit provides answers to questions and provides an exposure to careers in STEM fields

★ Final session is a repeat of the 1st session so that students and leaders can compare and see changes

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Lessons We Learned

★ Be very clear about your goals and objectives!

★ There is a great need for quality programming. Locations you may not think of need afterschool programming (military bases, etc).

★ Do your best at preparing your leaders – but then trust them to do their jobs. Ours were resourceful and inventive in ways we couldn't have imagined.

★ It WILL take more time than you think – try to plan for it.

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Lessons We Learned

★ Even with all the pressures of NCLB, the afterschool setting is ***not*** school – make sure it's fun and engaging.

★ Do not design a very structured program – it needs to be flexible to suit each program's needs.

★ Evaluation in free choice learning environment can be challenging – have fall-back evaluation strategies.

★ Seek partners and assistance where you need it – let other experts do their jobs as you do yours.

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Resources - Website

http://universe.nasa.gov/afterschool/

- 2 levels:
  - Top-level with general information for everyone
  - Password-protected resources for those who commit to running the program for target audience or who become a certified trainer for us.

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Resources - Manual

- Comprehensive manual:
  - "Recipe book" to run all of the sessions in the program
  - Each session is a self-contained recipe with background, activities, and extensions
  - Appendices provide additional info

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Evaluation report

★ Formal evaluation of the program sought feedback from both leaders and students:

- ✓ Leaders stated they met their primary goal of providing underserved students with an exposure to science they would not otherwise get
- ✓ Leaders stated that their own appreciation for science and astronomy increased
- ✓ The report also showed that students greatly enjoyed the hands-on nature of the program
- ✓ Students' content knowledge increased as a result of the program

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What Did Leaders Think?

- ★ “I found myself becoming more interested in these topics as well.”
- ★ “I was more enthused about astronomy because I now have a better understanding.”
- ★ “I felt empowered at the end because they walked away with so much knowledge – during the summer at that!”
- ★ “At the end of the day, I discovered that kids do like science. And they like it even better when its hands-on.”

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What Did Students Think?

- ★ “It changed my idea of how big the Universe really is.”
- ★ “I thought it was geeky but it is very very interesting doing experiments.”
- ★ “Science is fun!”
- ★ “My favorite part was… all of it.”

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WE WANT YOU!

We’re looking for trainers to expand our reach to out-of-school networks around the country!

Bring Afterschool Universe into your established out-of-school network

OR

join us as an “Afterschool Universe Ambassador” to help us meet demand!

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Train-the-Trainer Workshop

- We're accepting applications for a special training workshop in December 2010:
  - Special 3-day training for trainers representing networks (12 slots) or freelance trainer "ambassadors" (3 slots)
  - We'll cover travel expenses, provide materials, and help you train implementers on Afterschool Universe
  - In exchange, you'll commit to training others (in your network or beyond) and providing evaluation information for our research

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