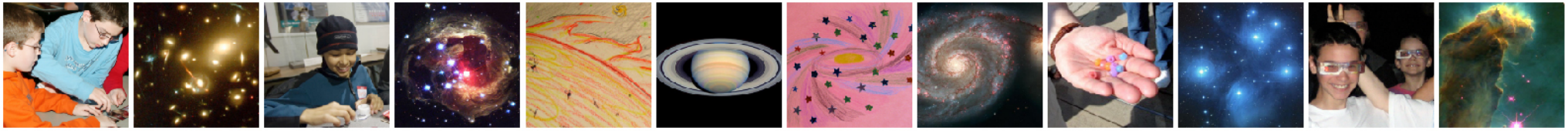


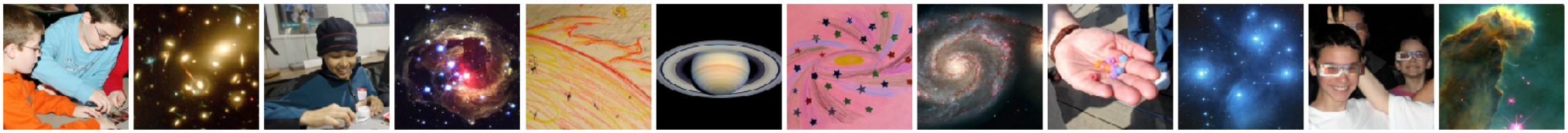
Afterschool Universe:
Astronomy for All

Sarah Eyermann & Sara Mitchell

CRESST/University of Maryland, College Park
NASA Goddard Space Flight Center

NASA

NSSEC
NASA SPACE SCIENCE
EDUCATION CONSORTIUM



Goals of this Workshop

In this session you will…

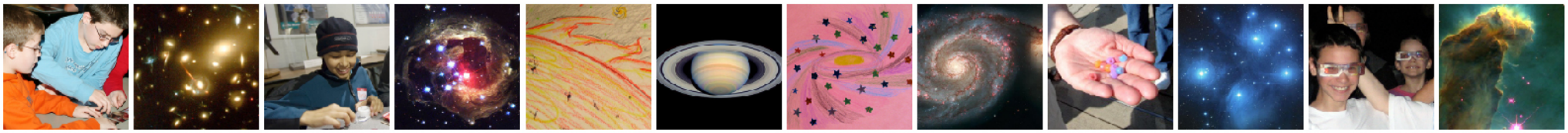
★ Learn what Afterschool Universe is, and how you can access it

★ Try your hand at activities from the Afterschool Universe program

★ Make NASA contacts for your future questions (us!)

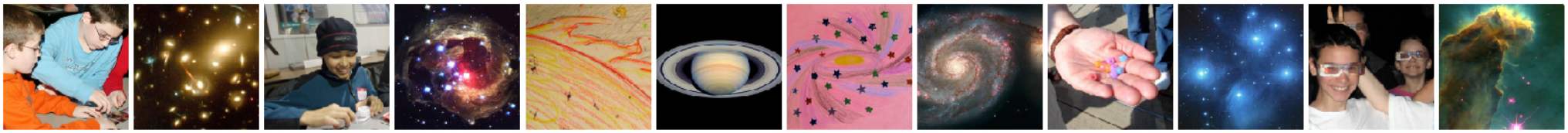
NASA

Afterschool Universe



What is Afterschool Universe?

- ★ A growing out-of-school-time curriculum that explores the universe and how we study it
- ★ Filled with hands-on, real-world astronomy activities for middle-schoolers
- ★ Uses different techniques to reach different types of learners: art, kinesthetic activities, writing, building, and more



Structure

★ 13 session curriculum (45-60 minutes each)

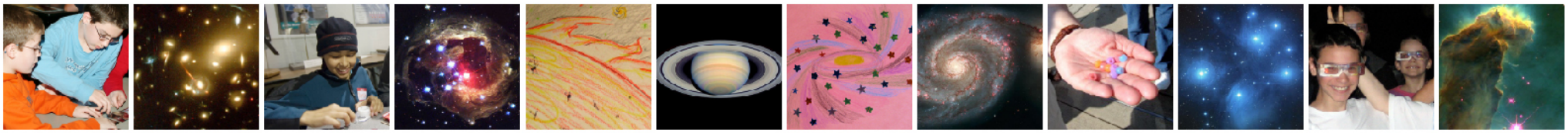
★ Run some or all sessions to suit your schedule:

- ✦ Every hour for 2 days
- ✦ Every day for 2 weeks
- ✦ Once a week for 13 weeks
- ✦ Split into blocks of modules

★ Students not required to attend all sessions to understand and benefit from program content

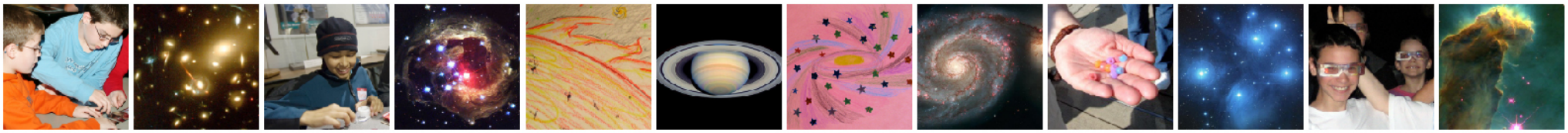
★ No preliminary science knowledge required for program leader – we'll give you the background!

Afterschool Universe



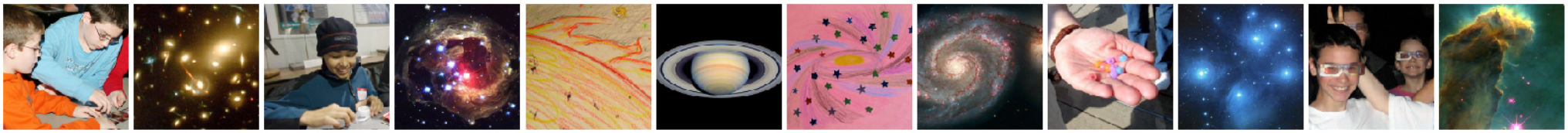
Program Content

- ★ Two sessions to start students thinking about what's out there and introduce basic process skills
- ★ Three sessions about the tools astronomers use to gather information from light
- ★ Six sessions discuss components of the Universe and how they fit together
- ★ Two sessions that allow students to share what they have learned



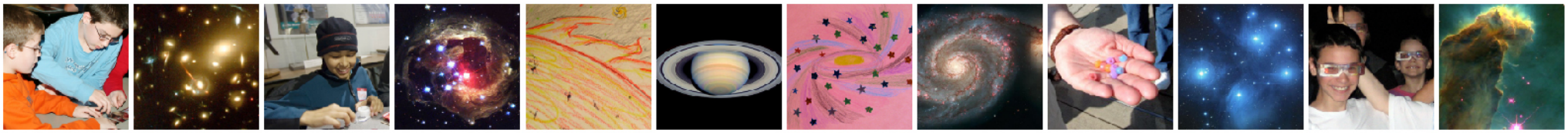
Curriculum Development

- ★ Many activities adapted from existing well-tested education resources
- ★ Consulted with afterschool providers during development
- ★ Extensively pilot-tested and evaluated to ensure we got it right!



Evaluation History

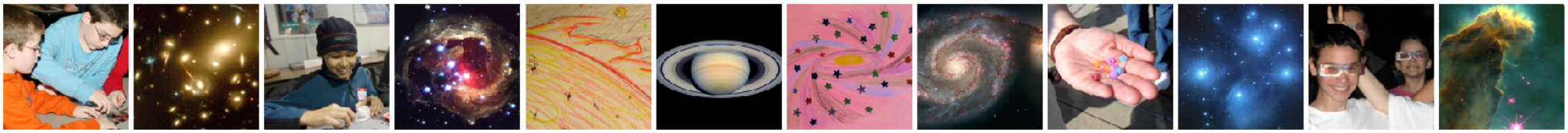
- ★ 2 years of pilot testing before the program was released
  - ★ Sought feedback from both leaders and students
  - ★ Revised and refined based on evaluation results
- ★ Train-the-trainer dissemination model evaluated separately at three tiers
- ★ Evaluation reports and sample tools available upon request



Resources

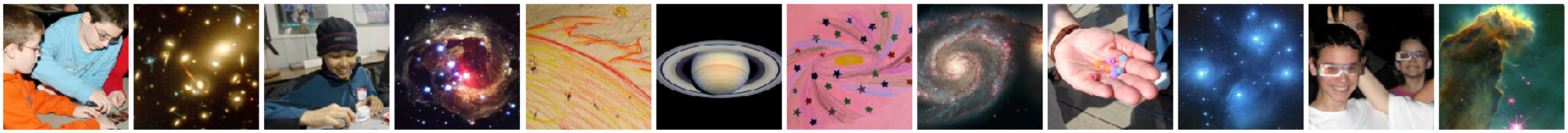
- ★ Comprehensive manual available on the website
- ★ Each session is a self-contained recipe with background information, activity instructions, materials lists, and extra resources
- ★ YouTube videos to help illustrate some of the activities
- ★ Sign up for our online mailing list to learn about new content and training workshops

Afterschool Universe



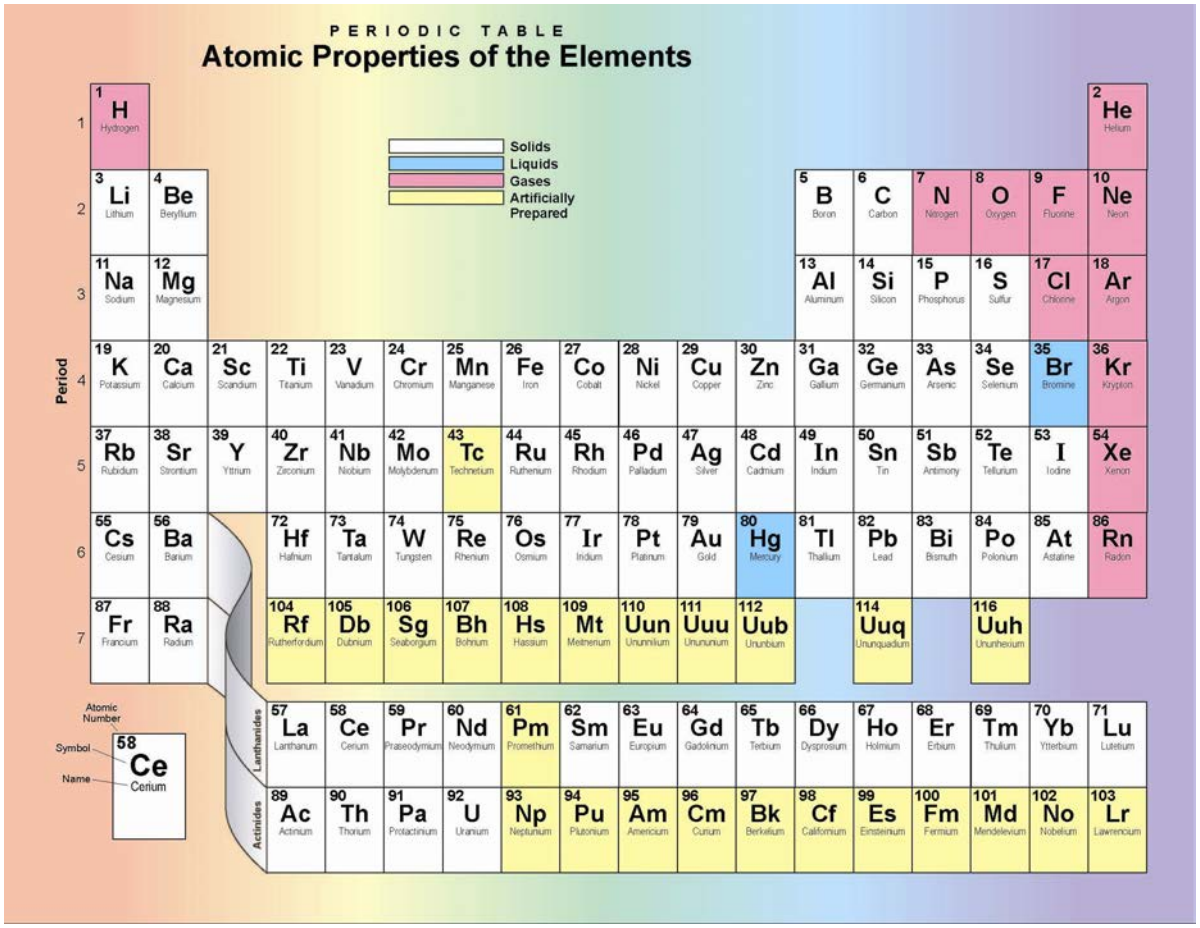
Let's do an activity!

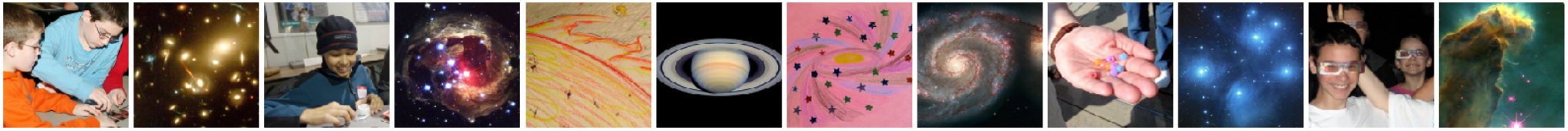
Afterschool Universe



Cosmic Connection to the Elements

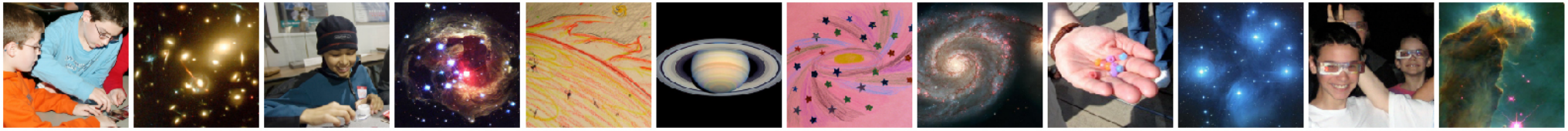
★ Explore the distribution of the chemical elements in the universe





Elements

Afterschool Universe



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)

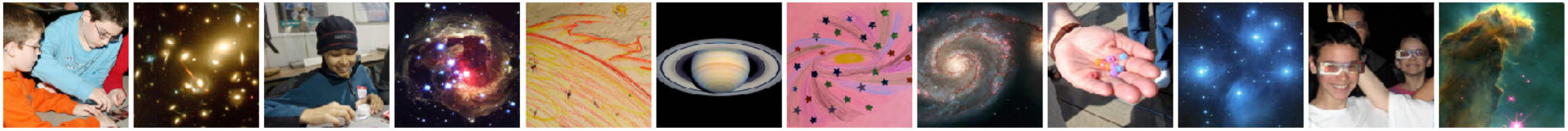
Pink Beans = Nitrogen (N)

Rice = Hydrogen (H)

Red Sprinkles = Iron (Fe)

Yellow Sprinkles = Sulfur (S)

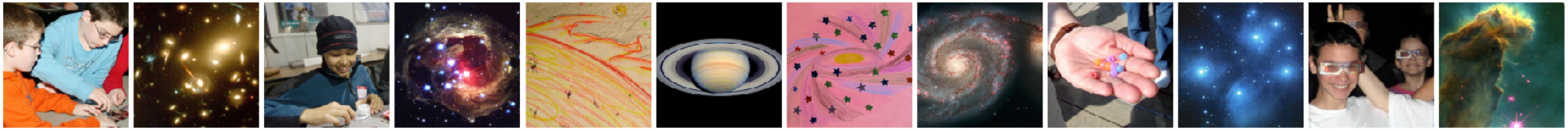
Afterschool Universe



INGREDIENT	ELEMENT	HOW MANY?
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)	

1. In my sample, I had the most _____ (element)
2. In my sample, I had the second most _____ (element)
3. Did you find all of the elements in your sample? _____
4. Did all of the elements have similar amounts? _____

Afterschool Universe



PERIODIC TABLE

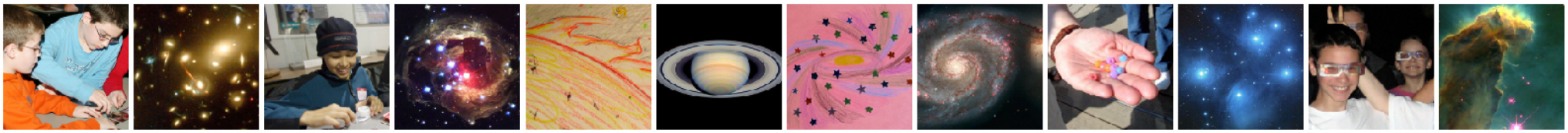
Atomic Properties of the Elements

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

Solids
Liquids
Gases
Artificially Prepared

Atomic Number
Symbol
Name
58 Ce Cerium

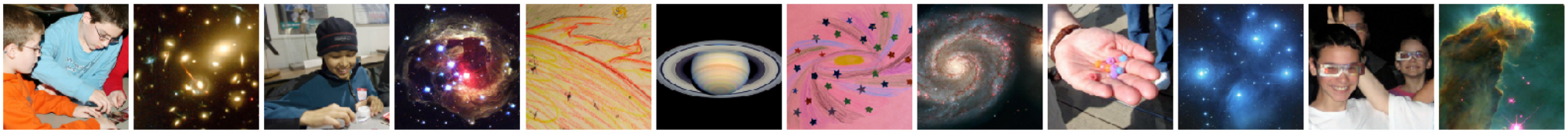
Afterschool Universe



Help us save our universe!

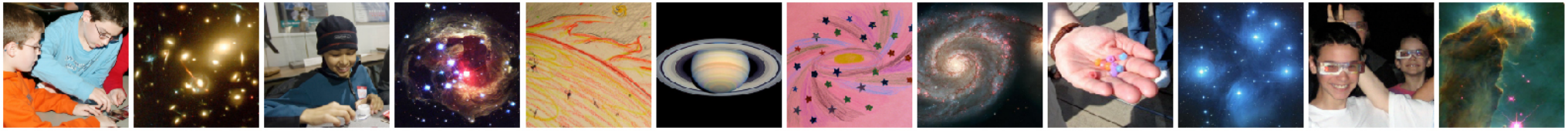
- ★ Carefully funnel your trail mix back into the tubs
- ★ We will also collect any laminated handouts

Afterschool Universe

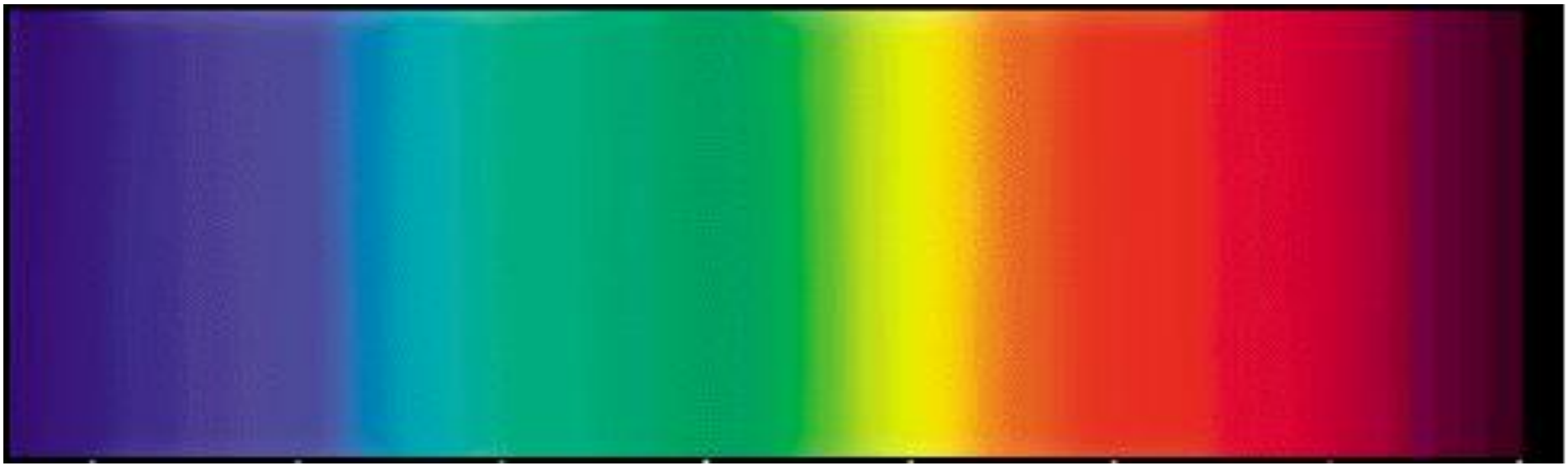


But how do we know?

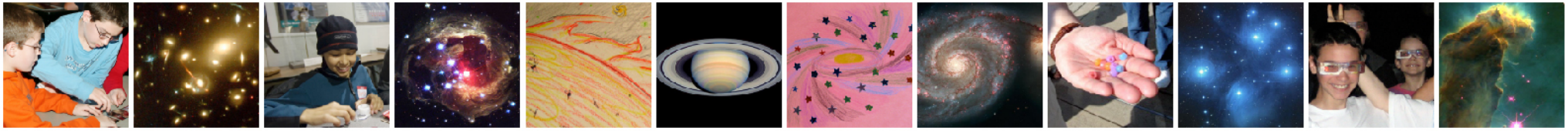
Afterschool Universe



Spectroscopes

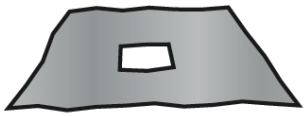


Afterschool Universe

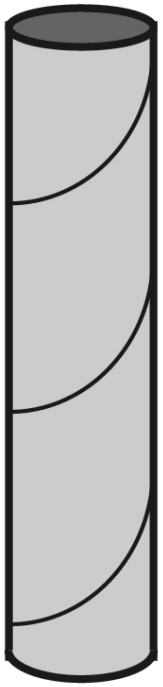


Spectroscopes

Eyepiece



Diffraction Grating End

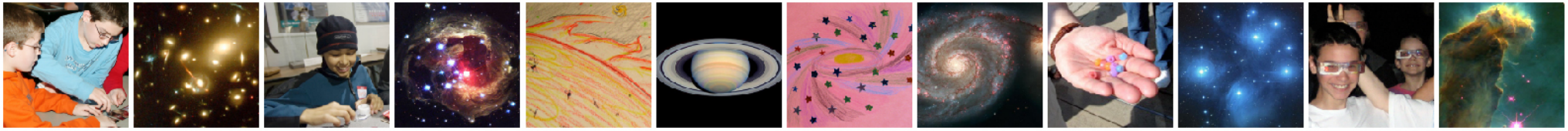


Paper Towel Tube

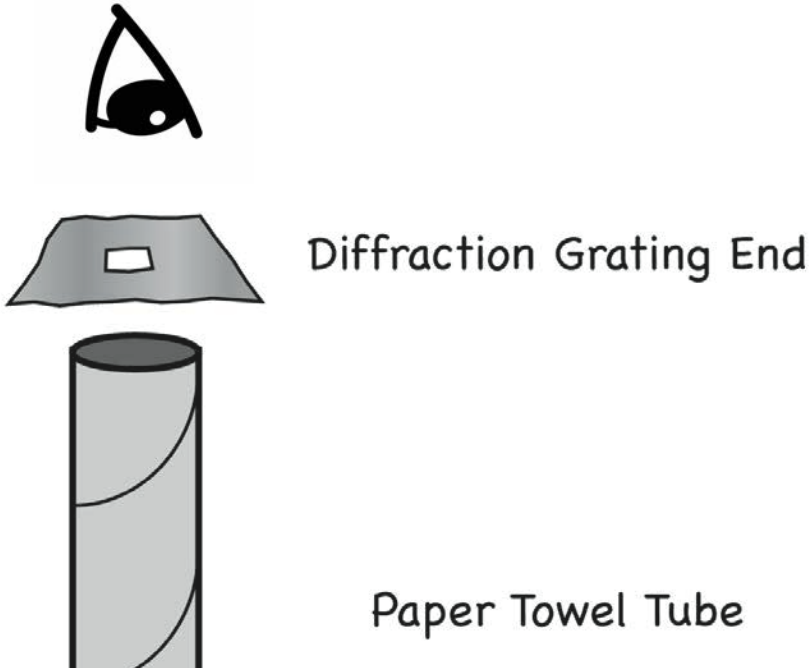
Objective

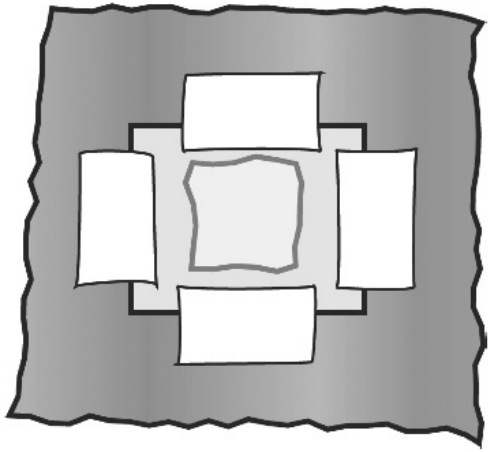
Slit End

Afterschool Universe



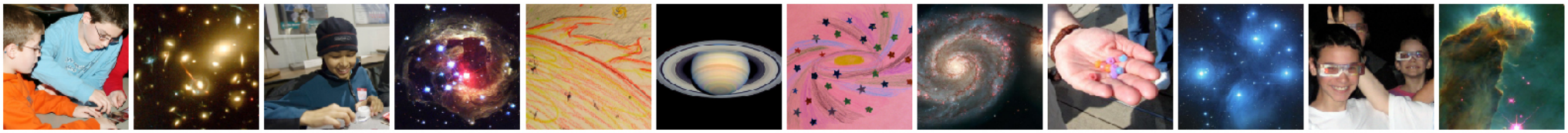
Spectroscope – Eyepiece End



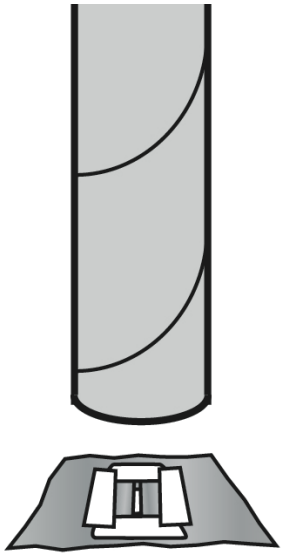


This end goes up to your eye (thus "eyepiece")!

Afterschool Universe

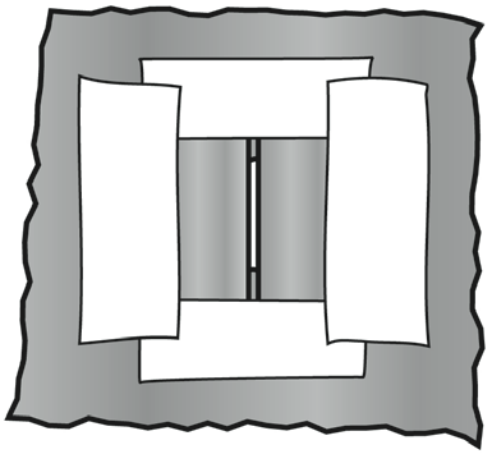


Spectroscope – Objective End



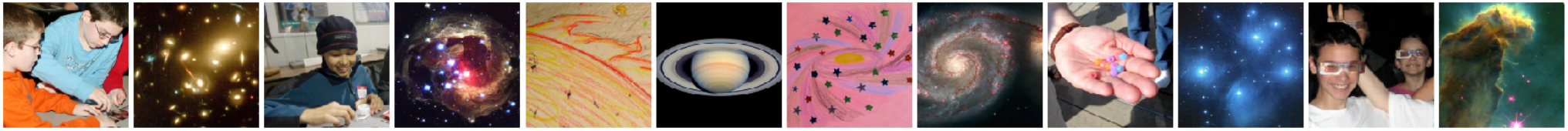
Paper Towel Tube

Slit End

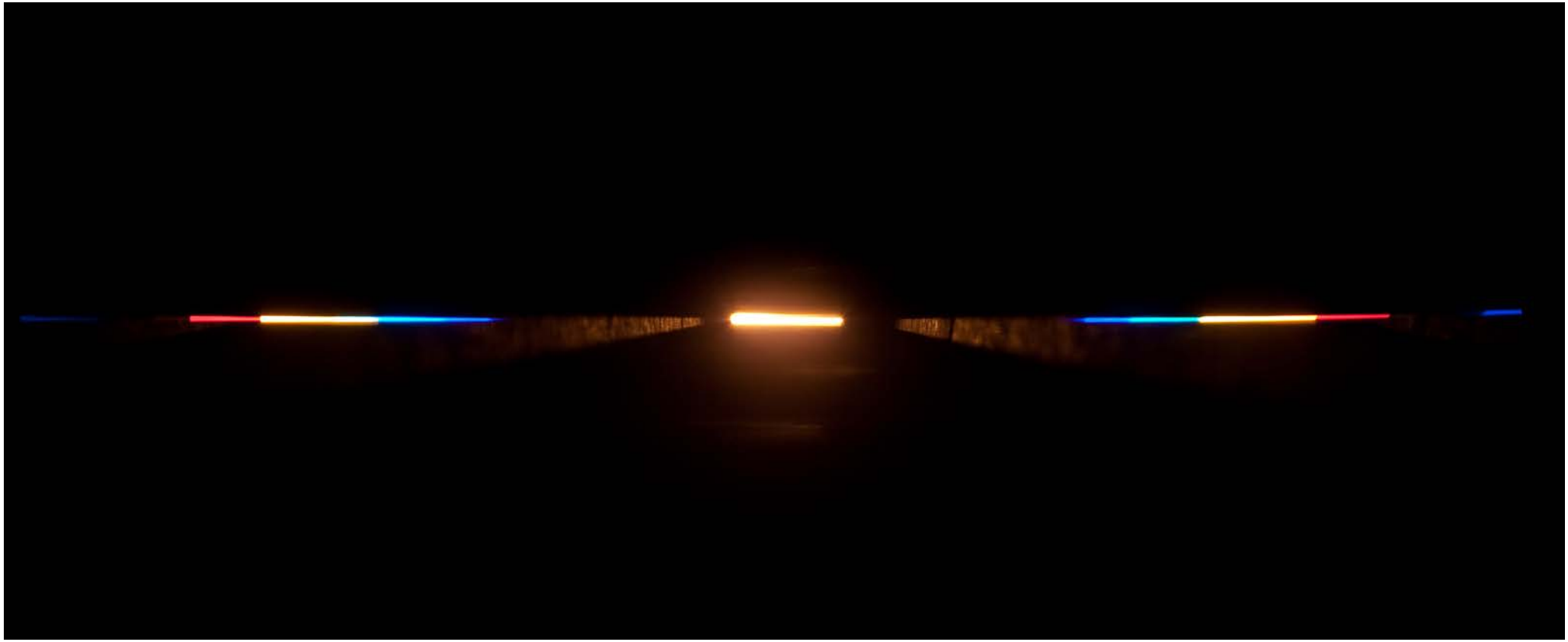


This end points at the object (thus "objective")!

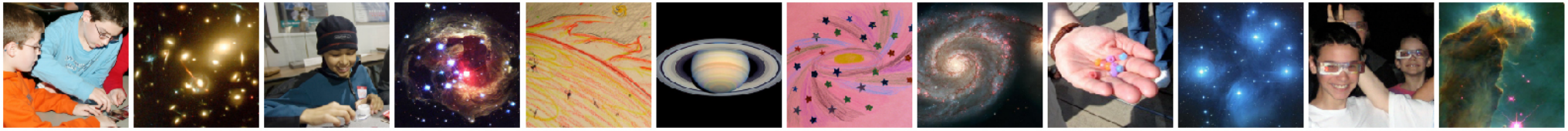
Afterschool Universe



Alignment

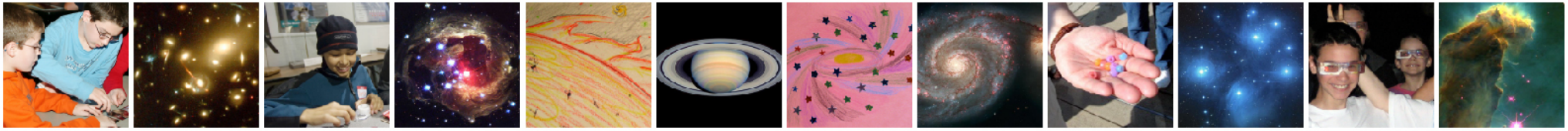


Afterschool Universe

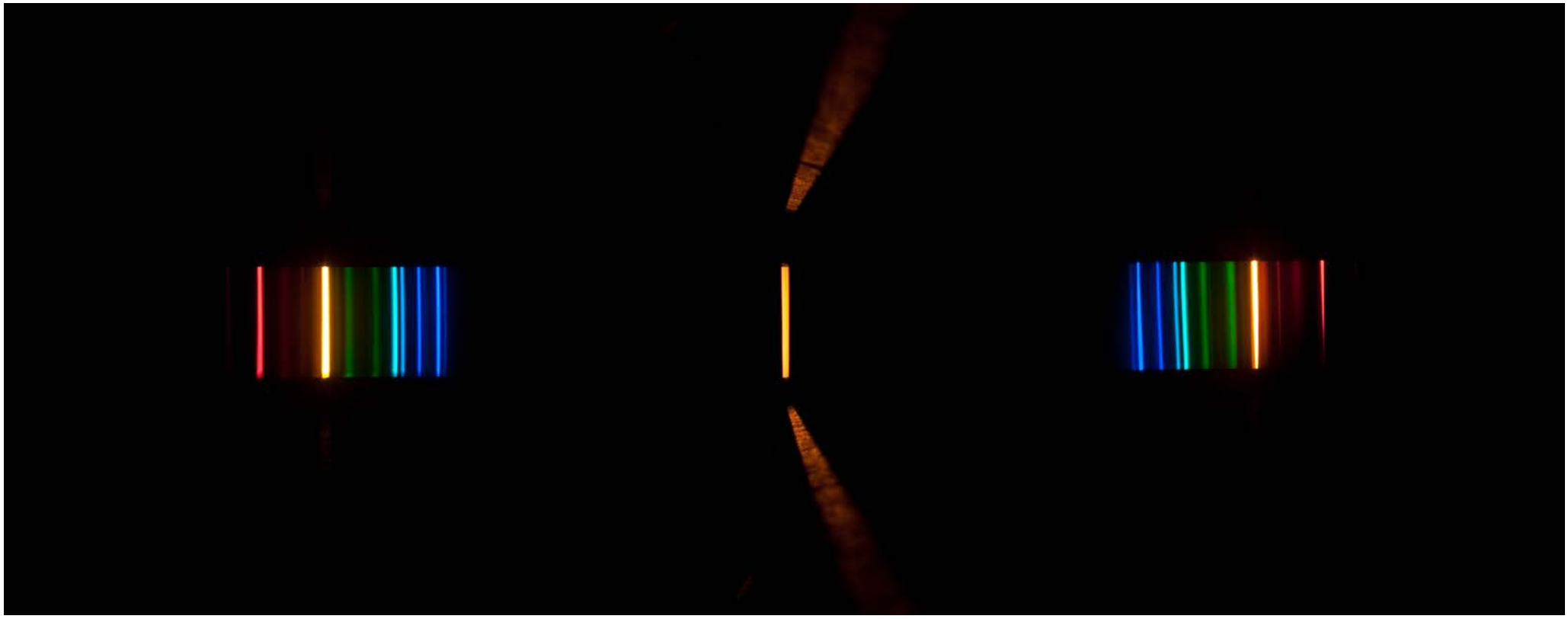


Alignment

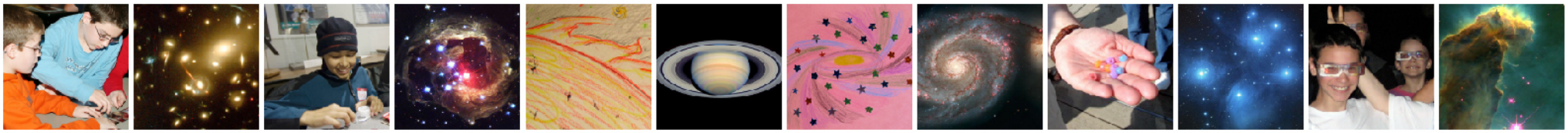
Afterschool Universe



Alignment



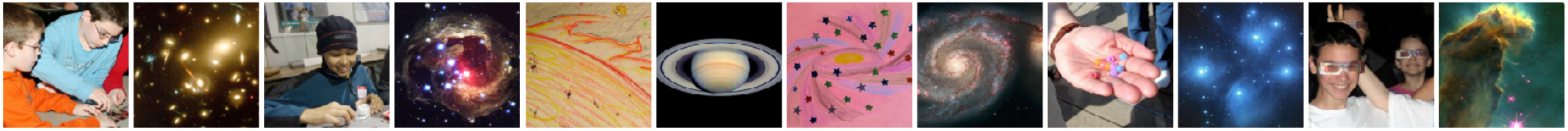
Afterschool Universe



What is this plastic stuff?

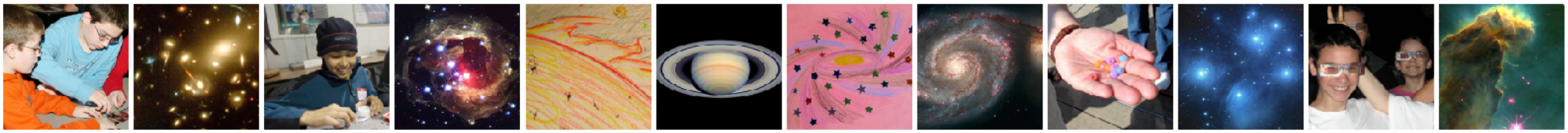
- ★ It's called "diffraction grating"
- ★ Sold by a variety of science education supply stores – I suggest a Google search for the best current options
- ★ You want single axis (not double axis or holographic) with 500 lines/mm (very common)

Afterschool Universe



Never look at the sun!

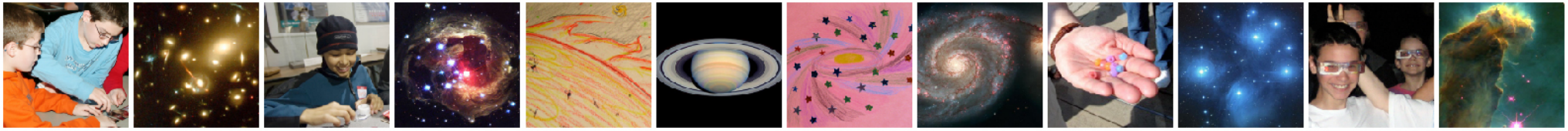
Afterschool Universe



Spectroscopes

It's pretty, but why is it science?

Afterschool Universe

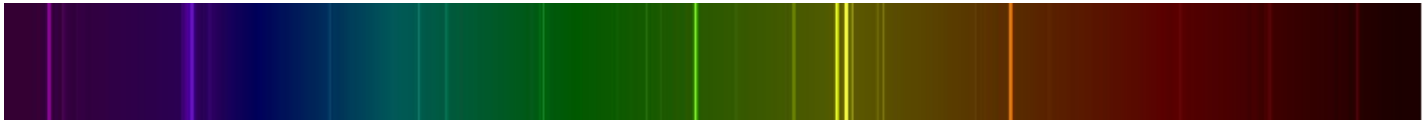


Hydrogen

Oxygen

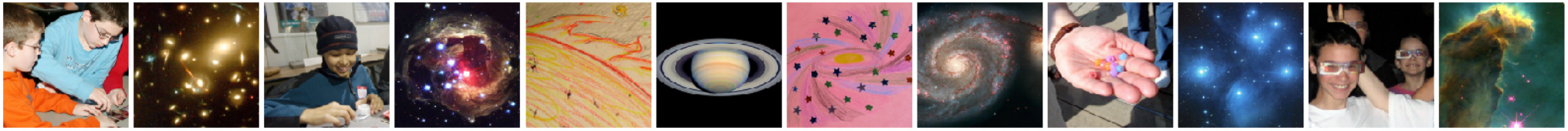
Nitrogen

Mercury

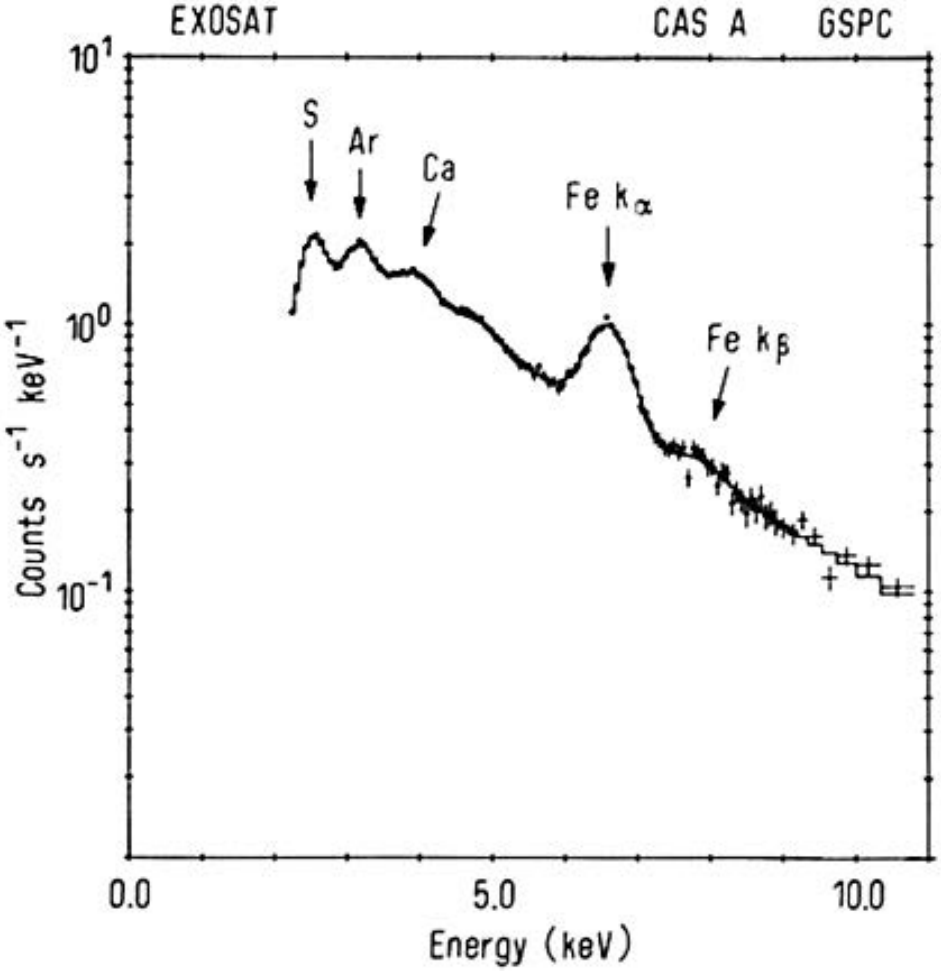


Sodium

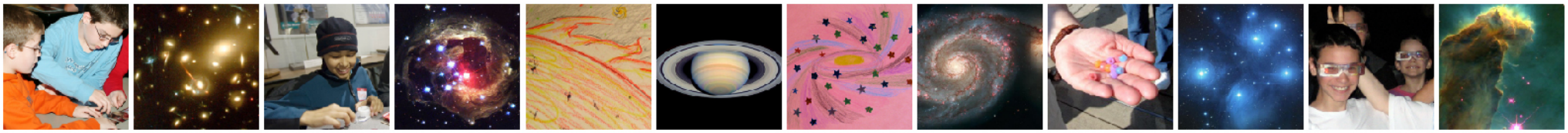
Afterschool Universe



What Astronomers See



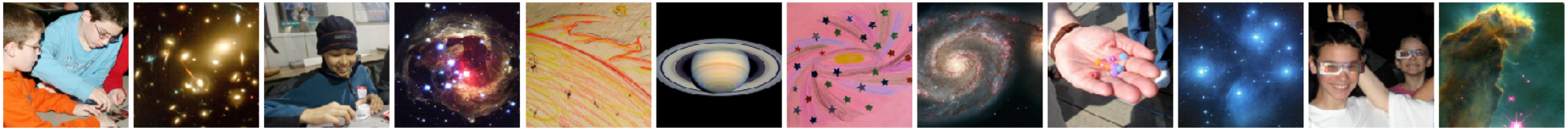
Afterschool Universe



Spectroscopes – Wrap-up

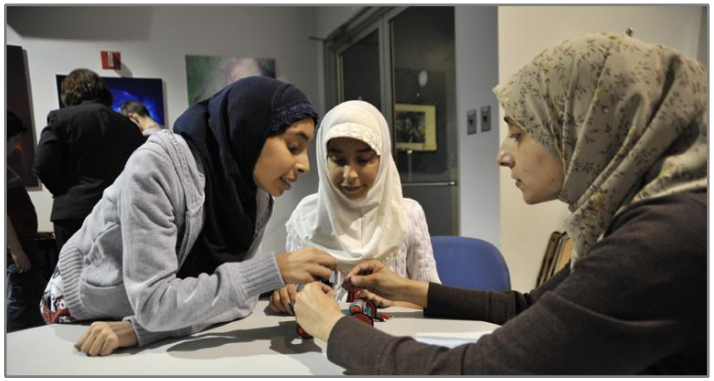
- ★ This spectroscope is yours to keep – explore different types of lightbulbs
- ★ Don't use these to look directly at the Sun!!!

Afterschool Universe



NASA Family Science Night

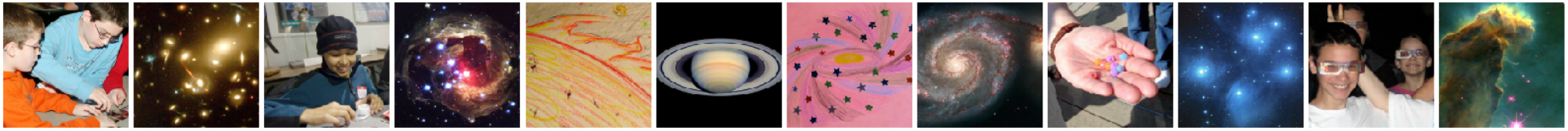
- ★ Designed for middle-school students and their families to engage in STEM activities together in an enjoyable, unintimidating environment
- ★ Session topics drawn from across NASA with connections to everyday life to make content relatable and relevant
- ★ Activities chosen to engage participants *as a family* to boost confidence and collaboration skills



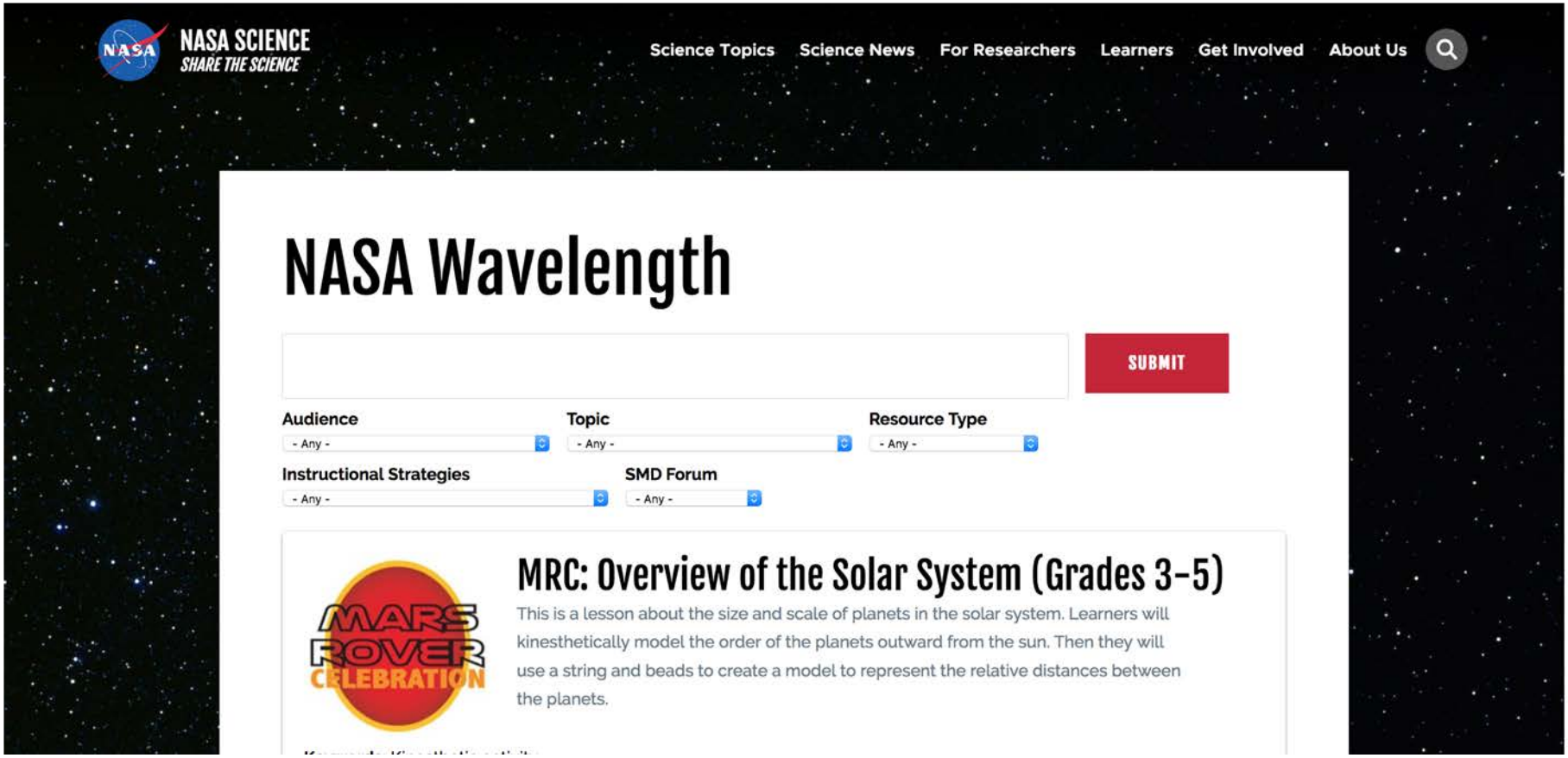
FAMILY SCIENCE NIGHT

NASA

Afterschool Universe



NASAWavelength.org



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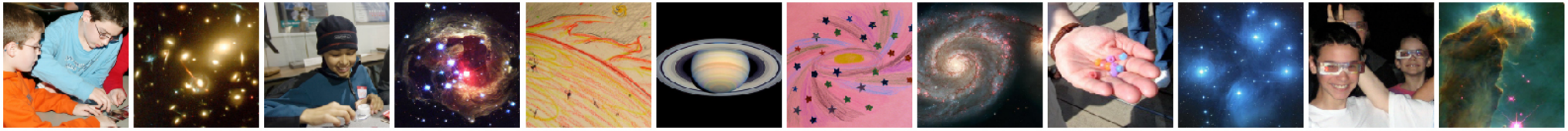

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