

Professional Development Final Report:
NGSS Lessons and Assessments for Big Bang Evidence (HS-ESS1-2) for the New Physics of
the Universe Course

NASA Endeavor
STEM Leadership Seminar

FINAL REPORT

I. Title: NGSS Lessons and Assessments for Big Bang Evidence (HS-ESS1-2) for the new Physics of the Universe course

II. Curriculum topics: As our district transitions to the new three-course model of high school NGSS, our college-prep physics course is changing to “Physics of the Universe” and incorporates the new NGSS Physical Science Standards with Earth and Space Science Standards and Engineering, Technology and the Application of Science ETS standards.

School Name(s), Number of Educators, Grade Level(s): My audience is the physical science instructors in my district, San Dieguito Union High School District in San Diego, California. This includes 7th and 8th grade integrated science courses, high school chemistry and high school physics. There are about 60 physical science teachers and our class sizes are on average 42 students/class. The district has 13,000 students enrolled. The schools include five middle schools and five high schools: Canyon Crest Academy High School (the school where I teach), Carmel Valley Middle School, Diegueno Middle School, Earl Warren Middle School, La Costa Canyon High School, Oak Crest Middle School, Pacific Trails Middle School, San Dieguito HS Academy, Sunset High School, and Torrey Pines High School.

My district PD day was Tuesday, February 19th. All science teachers are meeting at a district school, Carmel Valley Middle School.

III. Standards Addressed.

NGSS and CCSS standards

PE: HS-ESS1-2

SEPs: Constructing Explanations and Designing Solutions

CCCs: Energy and Matter

DCIs: ESS1.A, PS4.B

CCSS: RST.11-12.1, WHST.9-12.2, MP.2

IV. Summary of Project (3-4 sentences up to a paragraph=What did I set out to do?)

In the morning session from 8:30am-11am, I will concentrate on having the teachers attempt the lessons as students, while sometimes putting on our teacher hats to discuss pedagogy practices. After the lesson, teachers break for lunch and come back in the afternoon (12:00pm-2:30pm) to look at resources and 3-D assessments for the morning activities. I will facilitate a discussion for ways to build upon and improve both the lesson and the assessments. In small groups and as a large group, we will look at what went well and what we'd like to improve.

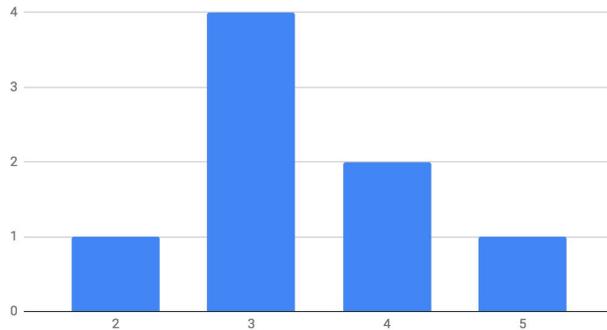
V. Pre-survey questions

- How familiar are you with the NGSS standards adopted by CA? (likert scale)
1 - Not at all

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5 - I can recite all the CCCs, DCIs, and SEPs for the new Physics of the Universe course

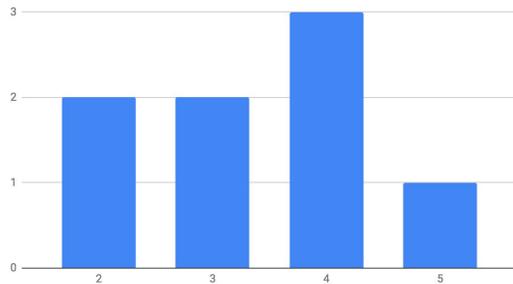
How familiar are you with the NGSS standards adopted by CA?



Summary: While no one was completely unfamiliar with the NGSS standards, most teachers that answered this question were somewhat familiar with NGSS standards, and most did not feel that they knew all of the CCCs, DCIs, SEPs, and PEs for the new Physics of the Universe Course.

- How often do you integrate real data into your lessons? (likert scale)
 1 - Not at all
 5 - always

How often do you integrate real data into your lessons?

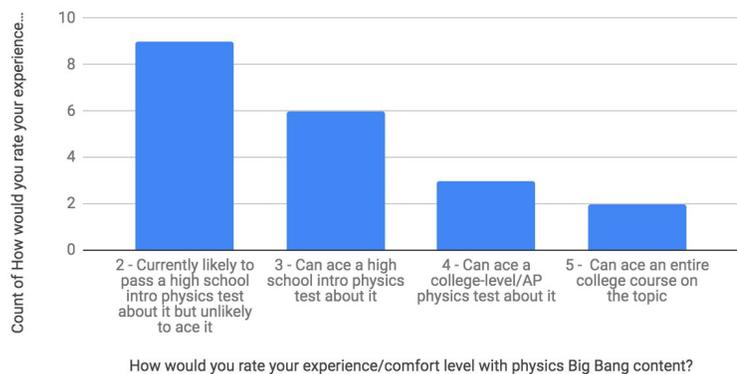


Summary: No one answered never or rarely do they integrate real data in their lessons. Most responding teachers answered that they are somewhere between sometimes and often using real data in the classroom.

- How would you rate your experience/comfort level with teaching the physics content and evidence of the Big Bang?

Summary: the range of experience and comfort within this group of teachers was fairly large with some teachers having a lot of experience and knowledge while most teachers were more unfamiliar saying that they were likely to pass a high school intro physics test about it, but unlikely to ace that test. This was good information to share with the group since there were a few teachers on the higher end who

Count of How would you rate your experience/comfort level with physics Big Bang content?



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could help more in heterogeneous groups. One teacher thought it wasn't necessary to go over some of the basic concepts, but the responses to this question helped support my decision to cover some of the basics. I looked at this before the session began to address the goal that this was a PD session for all teachers in our district, not just advanced teachers.

- What questions do you have regarding the Big Bang Theory? (fill in the blank)

Summary: several silly responses related to the Big Bang Theory TV show were here that I did not expect. Some responses were very specific relating to Hubble and most were very broad that they wanted to know all about it.

- If you could pick anything to do on a PD day with all of the Physics teachers in this district, what would you choose to do and why? (fill in the blank)

Summary: All teachers had something serious to say with this question, ranging from sharing lesson ideas and best practices, learning new demonstrations and labs, just getting ideas from each other, and creating lessons together on specific topics. To the right is a word-art image of the responses:



VI. Brief Description of the Actual Professional Development Training

During our District PD Day (8:30am - 2:30pm), I volunteered to lead the physics break-out session with the purpose to share resources and facilitate the experience and debriefing of lessons involved in our newly adopted curriculum for the NGSS high school 3 course-model "Physics of the Universe" course. The morning session 8:30-11am was devoted to experiencing the lesson itself and the afternoon (12 - 2:30pm) was spent on experiencing, analyzing, and developing 3D assessments for the morning lessons. For this training, I used resources on content and pedagogy from the coursework of the "Methods of STEM Education", "Physical Science in Motion: Classroom Applications", and "Astronomy and Space Science" courses.

VII. Brief Outline of the PD Activities

I'm including my slide presentation as part of my electronic portfolio and attaching as part of the appendices. The activities included astronomy lessons from JPL NASA, data integration from SDSS, and NSTA assessment activities. Teachers participated in a gallery walk, ranking tasks, quickwrites, activity summary board.

VIII. What NASA data did you include?

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The majority of NASA data, activities, and resources used in the PD was from my Astronomy and Space Sciences course including activities from <https://www.jpl.nasa.gov/edu/teach/> and <https://map.gsfc.nasa.gov/universe/> and <https://astronomy101.jpl.nasa.gov/materials/>. One of the significant lesson activities was inspired by the data integration lesson and discussion in the Methods of STEM Education course with using SDSS data to plot Hubble diagrams <http://cas.sdss.org/dr2/en/proj/basic/universe/simple.asp>.

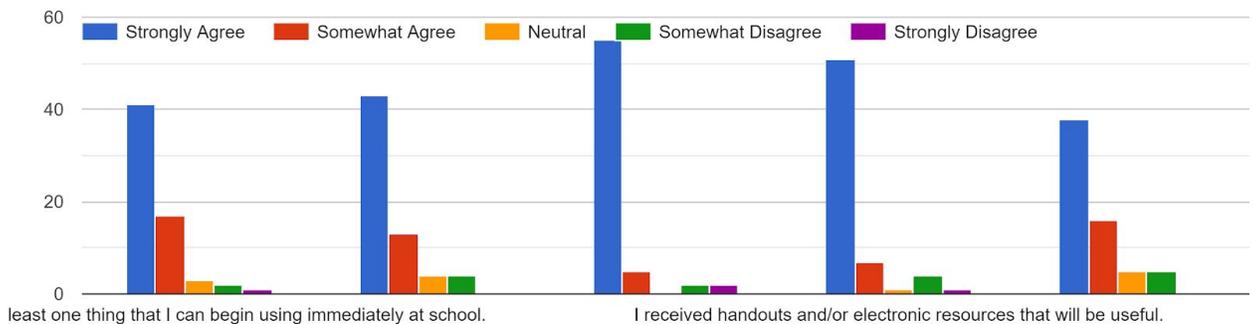
IX. Post-questions Survey Questions

1. Rate the following (likert scale):

- I learned at least one thing that I can begin using immediately at school.
- The presentation was communicated effectively and engaged the audience
- The content presented was relevant to my job.
- I received handouts and/or electronic resources that will be useful.
- Time in the workshop was sufficient to allow learning and practicing new concepts.

The outcomes of the survey are posted below. Overwhelmingly, most teachers agreed that the content in the PD was useful, relevant, and engaging.

Please rate the following.

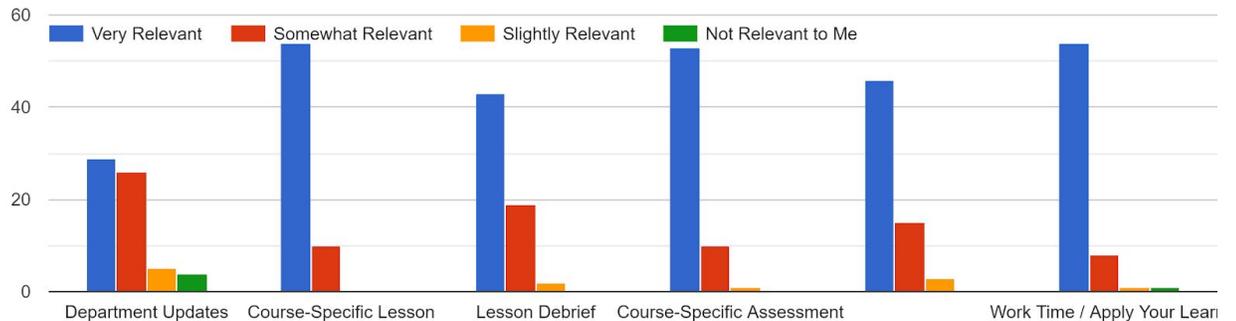


2. Rate the relevance of the session component to your needs/practice (likert scale):

- Department Updates
- The Cosmology NGSS 5E Lessons
- The Lessons Debrief
- The NGSS Space Science Assessments
- The Assessment Debrief
- Overall work time / application of learning

The outcomes of the survey are posted below. Overwhelmingly, most teachers agreed that the content in the PD was useful and relevant to their needs.

Please rate the relevance of each session component to your needs/practice.



3. Describe one positive take-away you learned during the professional development. (Fill in the blank)
4. What additional support do you need to implement what you learned?(Fill in the blank)
5. If you weren't satisfied with any part of the session, please explain why. (Fill in the blank)

X. Outcomes. Final Data Collection and Analysis

a. PD Content

Survey analysis and informal interviews were very positive regarding the content given in our PD. All teachers said that they would use these lessons in class for our new NGSS Physics of the Universe (HS 3 course model). Teachers at different levels (middle school and AP Physics) also said that they would adapt the lessons for their own classes.

b. PD Pedagogy

Teachers responded that they learned during this PD event. From the post-survey questions and from the pre/post wall checks, all teachers shared very positive take-aways. All said that they learned something new that they can use in their classroom. Here is a sample of three responses to the survey:

"I feel this is a lesson that I can use in my classroom (it build upon what I do and adds more!)"

"Seeing a lesson in action and the planning/analysis involved helped to give me a better starting point."

"Being in the same room is so beneficial! The more we work together, the better our teaching."

c. Was your professional development successful? Why or Why Not?

I believe my PD to have been successful, but to continue being useful, I believe there needs to be more hours and more follow-up and more training with my colleagues. From several weeks ago, a quote has stuck with me, "Great teaching is a team sport," (Fulton and Briton, 2011) and for this PD to truly be successful, I need to keep working with my team throughout the whole

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teaching season. Also from our literature, in order to be successful in growing the confidence of teachers, there needs to be significant time incorporated for the lasting duration of professional development training and knowledge (DeSimone, 2011). I believe my single day of training went as well as it could have, but I need to continuously follow up with my teachers in order for this to truly be successful. Also, overwhelmingly and not surprisingly, in the survey, most teachers said they needed more time as additional support as we transition to new courses with new activities and a new role for the teacher in the classroom.

d. How did this project relate to the readings? Cite two examples.

"Great teaching is a team sport," (Fulton & Briton, 2011) and I plan to continue working with my PLC teachers in my district so that they can see the benefits of collaboration. The responses from the days' PD session were very positive, but we need to continue the work in a PLC to support each other and continue developing as professionals at our schools. Since beginning this course, I have asked my district for more support and time for PLC and I was granted it. Now I meet weekly with my PLC before school everyday so that we can continue to improve our teaching for our students. This also relates to DeSimone's toolkit for measuring effective PD with the duration component of having more hours to support the training after the PD day. From DeSimone, I also made sure there was an active learning component in my PD. Teachers had to be doing activities. Teachers got up, moved around, talked with each other, evaluated statements, argued from evidence, used data to make graphs, and analyzed both their work and the pedagogy of the activities.

References:

- Fulton, K. & Briton, T. (2011). STEM Teachers in Professional Learning Committees: From Good Teachers to Great Teaching. *LINCS | Adult Education and Literacy | U.S. Department of Education*, The National Commission on Teaching and America's Future, 28 July 2017, lincs.ed.gov/professional-development/resource-collections/profile-731.
- Desimone, L. (2011). A primer on effective professional development. *Kappan* 92(6) 68-71.

e. Will the teacher do these activities again?

Based on the feedback from the teachers, yes! Many spoke about the modifications they would make for the lessons to work better for them and their students. Differences in teaching styles with students at different levels (middle school, high school AP and non-AP courses) and on different schedules (block and four-by-four schedules for high schools) are reasons for modifications, but overall, all teachers thought the activities were useful and applicable to their classes. Although a few teachers have taught Big Bang physics in that past, most had not and all teachers were excited by the new resources and assessment ideas.

f. Reflection

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Most of the PD went very well. The activities went well and the assessment went well. What really needs to be improved is having more PLC time throughout the rest of the year. Ideally, this would be weekly PLC time to continue the support that is needed for our district to support great teaching. The activities need to be revisited after we do them with students so that we can make adjustments and modifications for our students at our schools. Our teachers need support and time to continue feeling confident in our own abilities and in the abilities of our students.

XI. Appendix: Classroom Activities/Unit with Assessment

Here is an outline of my presentation. Slides 1-27 for the morning session. Slides 28-52 for afternoon.

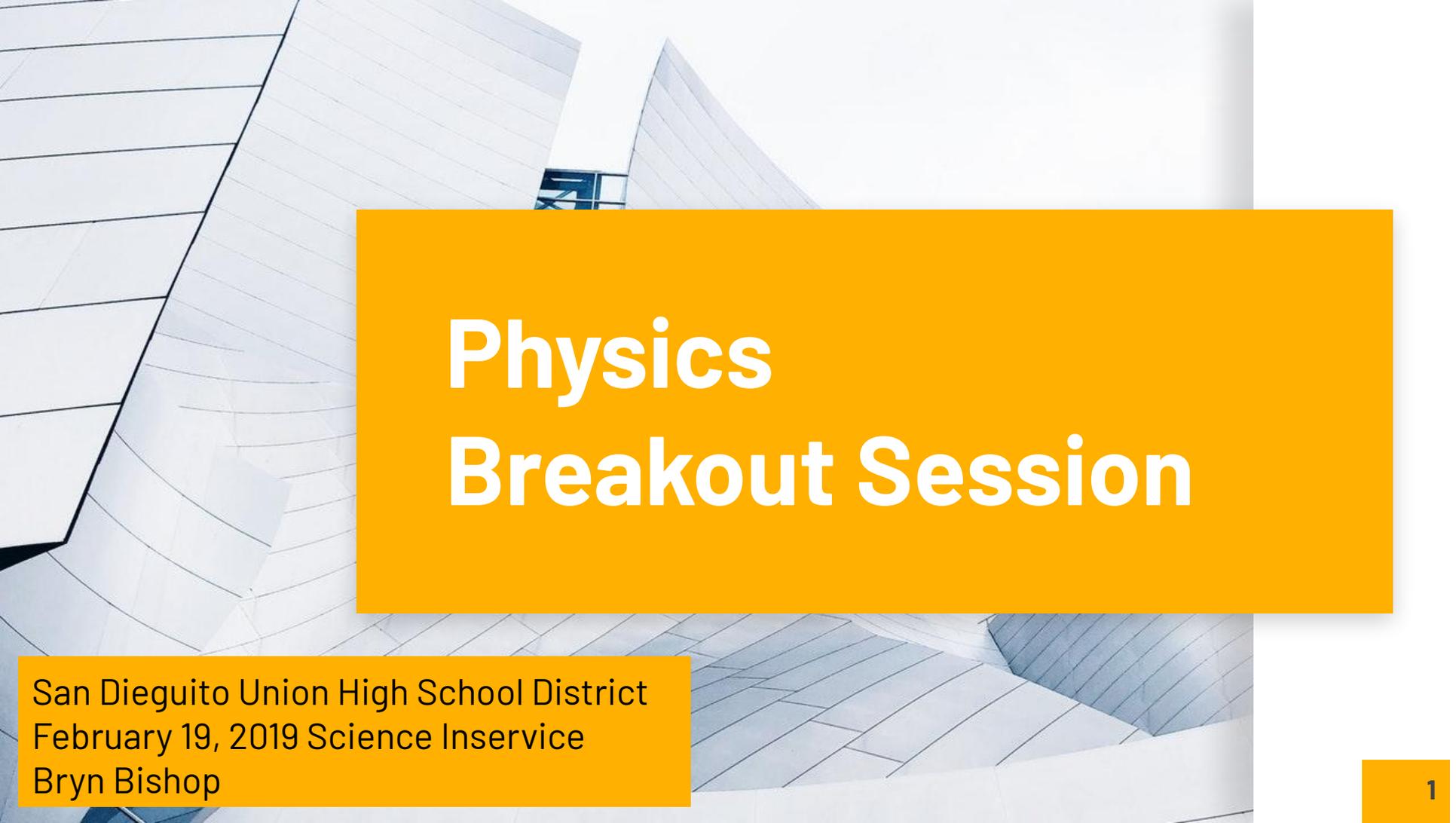
Slide Number(s)	Activity
1-2	Introduction
3-4	Reviewing common acronyms
5	PD norms
6-7	Creating a Google Classroom and doing pre-survey
8	Introducing NASA's JPL Education Website for Activities, resources, workshops, and programs
9	Introduce NGSS Cosmology Big Idea and NASA's WMAP Universe Cosmology
10-13	Gallery Walk with ranking task exercise (from NASA resources in Astronomy and Space Science course https://astronomy101.jpl.nasa.gov/download/workshopfiles/SizeScale_22.pdf)
14-17	Big Ideas with Quickwrites, questions, and table sharing
18 - 19	Expanding Model Simulation and NASA Activity https://www.jpl.nasa.gov/edu/teach/activity/collecting-light-inverse-square-law-demo/
20-25	Review Doppler Effect
26-27	NASA Build a Spectrometer Activity
28	Using SDSS data to create a Hubble Plot (data integration activity)
29-30	Hubble's real data and implications for space-time

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31	End morning with NASA math challenge assessments to consider before afternoon focus on assessments
32	Lunch Break / afternoon assessment introduction
33	Assessment Pre-check on wall posters
34 - 40	Assessment session content: Examples, components, architecture, criteria, implications, and resources for our district.
41	Assessment Post-check on wall posters (new color)
42	Lesson Debrief (using template)
43-45	Assessment strategies used during morning sessions
46 - 50	Pedagogy and resources for NGSS lessons
51-52	Discussion on improving lesson
53 - 56	Time for teachers to work together on what they feel will be most meaningful before ending the PD day.

**Science Certificated Inservice Agenda
Carmel Valley Middle School**

Agenda Item	Time	Participants and Facilitators	Location
Breakfast and Check-In	7:30 - 8:00 am	All Science Teachers Vicki Kim (CVMS Principal) Jenn McCluan Cindi Schildhouse	CVMS Performing Arts Center (PAC)
Welcome and Overview Welcome Updates and Announcements “State of the Union”: Instructional Materials District Professional Growth Survey	8:00 - 8:30 am 8:00 - 8:05 am 8:05 - 8:10 am 8:10 - 8:20 am 8:20 - 8:30 am	All Science Teachers Vicki Kim (CVMS Principal) Cindi Schildhouse Bryan Marcus (Associate Superintendent) Jenn McCluan	CVMS Performing Arts Center (PAC)
Breakout Sessions Experience Course-Specific NGSS Lesson Lesson Debrief	8:30 - 11:00 am 8:30 - 10:00 am 10:00 - 11:00 am	Course-Alike Groups 7th: Kajyo Chen & Tania Kim 8th: Shaun Saville & Sasha Voigt Bio: Jessica Adams & Emily Steward Chem: Erinn Eddingfield & Angela Willden Phy: Bryn Bishop	Breakout Rooms 7th Grade: 405 8th Grade: 406 Biology: 407 Chemistry: 409 Physics: 408
Lunch	11:00 - 12:00 pm		On your own
Breakout Sessions Analyze Sample NGSS Assessment Work Time: Develop Lesson / Assessment Wrap-Up and Survey	12:00 - 2:30 pm 12:00 - 12:45 pm 12:45 - 2:15 pm 2:15 - 2:30 pm	Course-Alike Groups 7th: Kajyo Chen & Tania Kim 8th: Shaun Saville & Sasha Voigt Bio: Jessica Adams & Emily Steward Chem: Erinn Eddingfield & Angela Willden Phy: Bryn Bishop	Breakout Rooms 7th Grade: 405 8th Grade: 406 Biology: 407 Chemistry: 409 Physics: 408
Sign-Out All teachers sign out in PAC before leaving and Return Chromebooks	2:30 pm	All Science Teachers Vicki Kim (CVMS Principal)	CVMS Performing Arts Center (PAC)



Physics Breakout Session

San Dieguito Union High School District
February 19, 2019 Science Inservice
Bryn Bishop



Lawrence Livermore National Laboratory

UC DAVIS

DEPARTMENT OF PHYSICS

LSST Large Synoptic Survey Telescope

Bryn Bishop



Education: B.S., Physics, UC Davis; Teaching Cred, Sec. Sci, UC Davis; M.A. (expected May 2019) STEM Edu, NASA Endeavor & Adams State U.



Current: Physics teacher at CCA, VP for HS with SCAAPT, NPTW leader (@ USD this Saturday!)



Interests: Family, photography, astronomy, outdoors



Acronyms

E ntry

L evel

E mployee

N ice

G uy

S pongebob

S quarepants

C hocolate

C hip

C ookies



D ick

C heney's

I dea

S omeone

E lse's

P roblems

Acronyms

E s s e n t i a l
L e a r n i n g
E v e n t s

N e x t
G e n e r a t i o n
S c i e n c e
S t a n d a r d s

C r o s s
C u t t i n g
C o n c e p t s



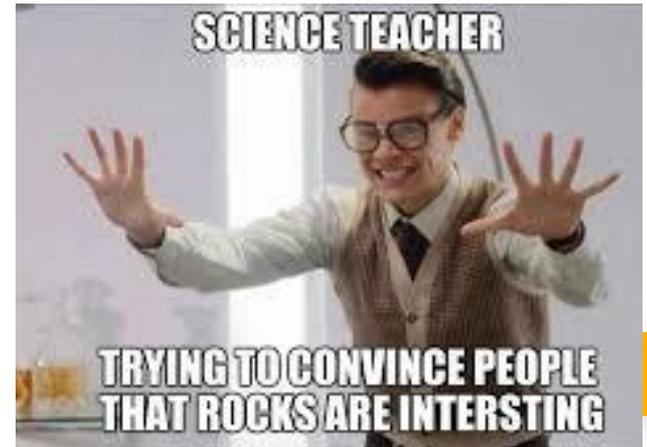
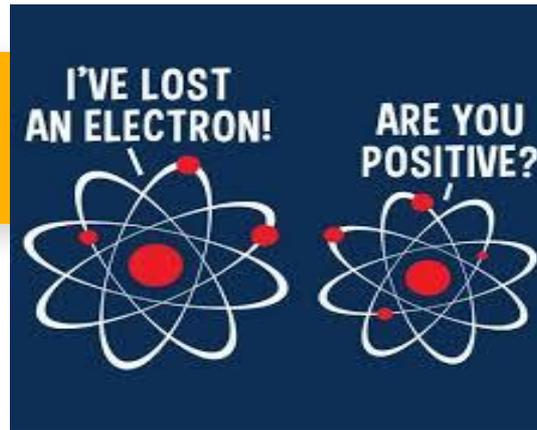
D i s c i p l i n a r y
C o r e
I d e a s

S c i e n c e &
E n g i n e e r i n g
P r a c t i c e s



Norms

- Let's stay positive
- Use time wisely
- Speak and listen respectfully
- Contribute equally, discuss concerns candidly
- Our focus: improve student learning!

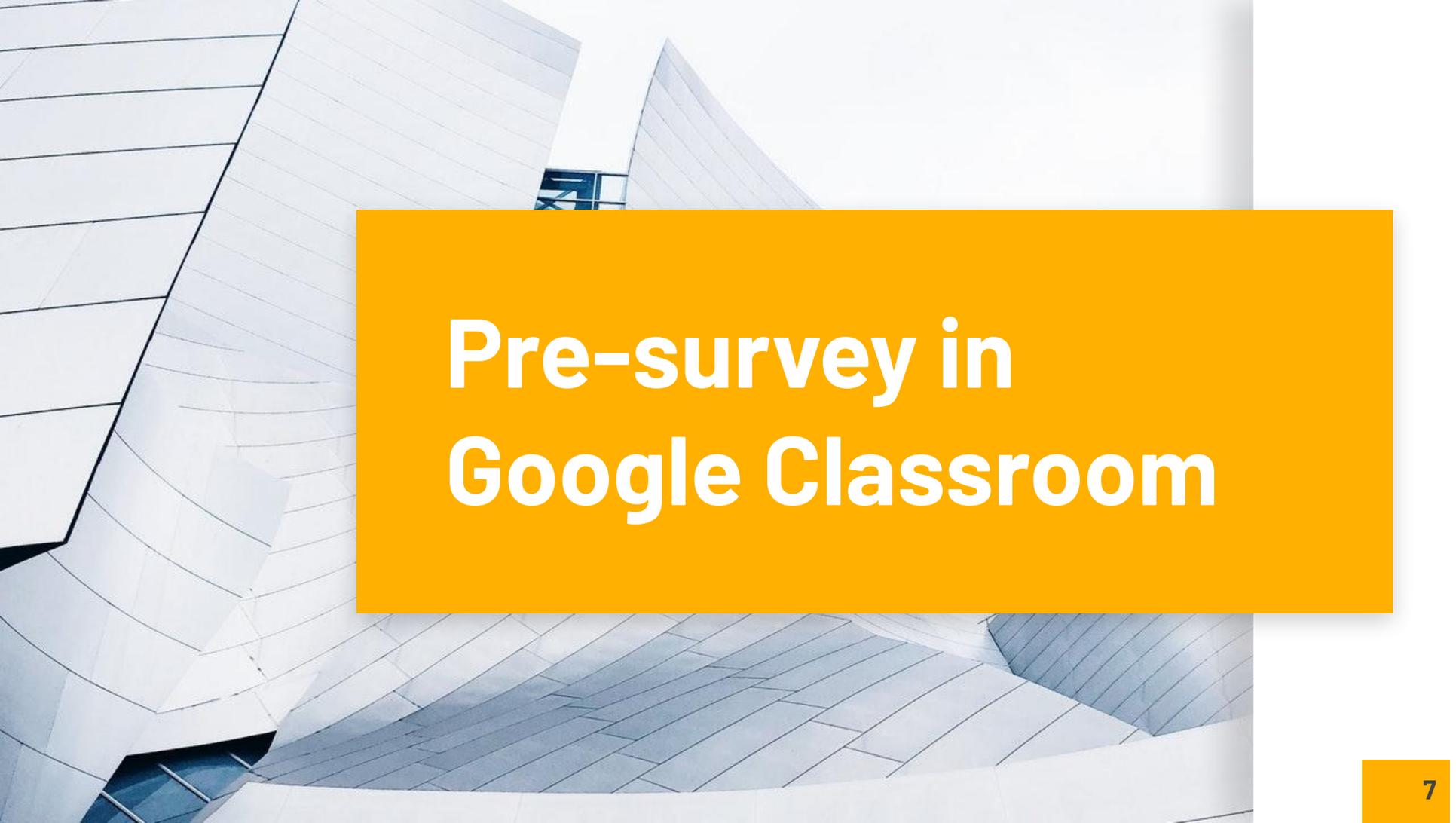


Google Classroom



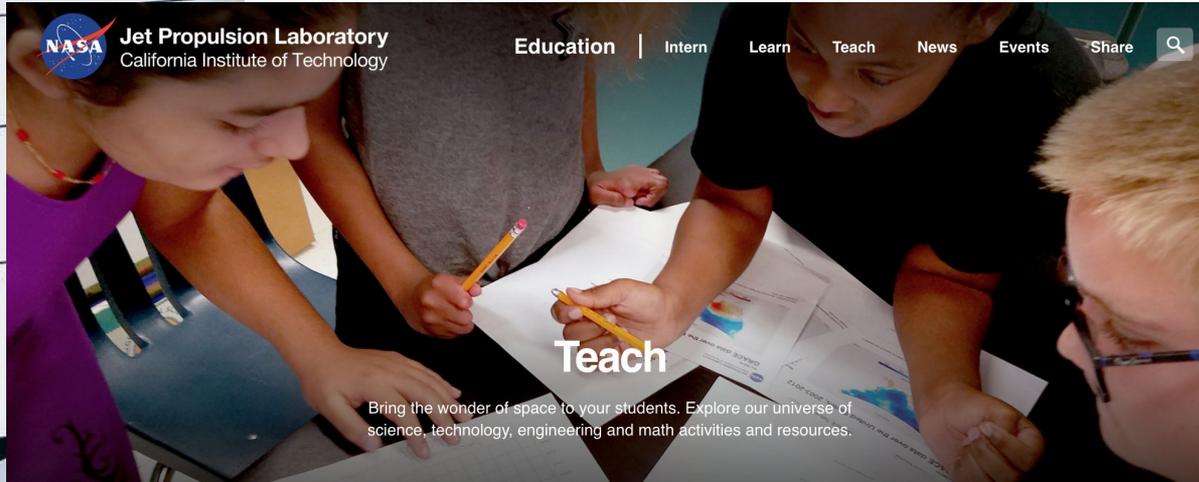
Setting up and
Joining a Google Classroom.





Pre-survey in Google Classroom

Activities for Teaching NGSS Physics of the Universe



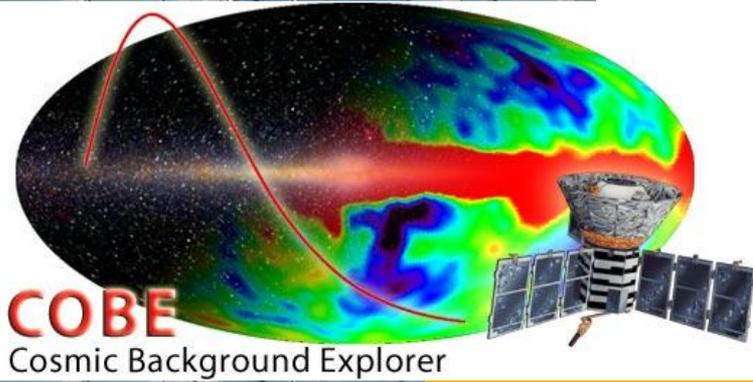
ACTIVITIES RESOURCES WORKSHOPS PROGRAMS

All Activities

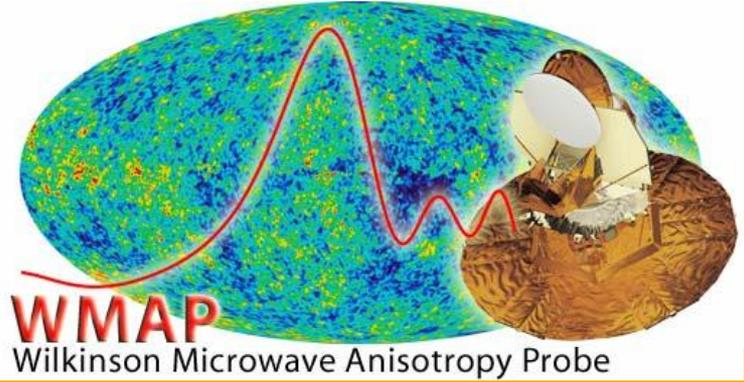


All types ▾ All subjects ▾ All grades ▾ All topics ▾ search 🔍

[NASA's JPL Education website](#) has a growing number of activities aligned with NGSS and Common Core Standards. Several of the activities we do today are from this site.



COBE
Cosmic Background Explorer

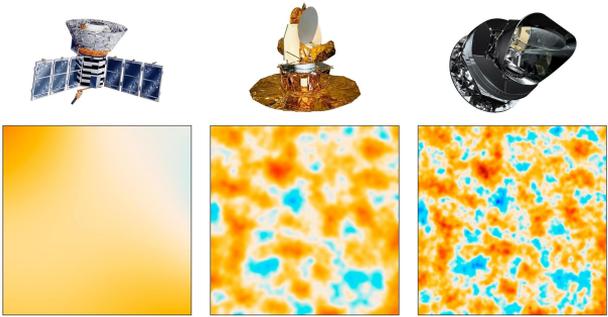


WMAP
Wilkinson Microwave Anisotropy Probe

Cosmology

“The scientific study of the large scale properties of the universe as a whole.” - NASA*

How has the universe changed over time, and how do we know?



COBE WMAP Planck



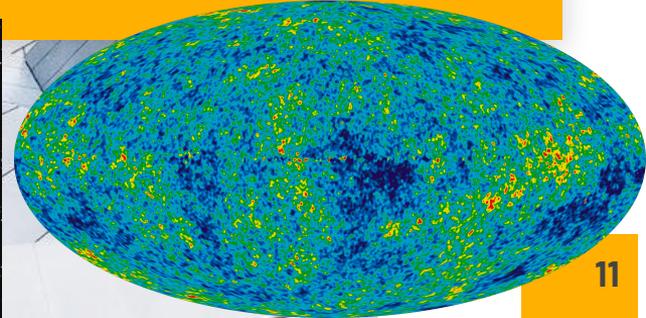
Gallery Walk- Photos

Around the room are a variety of photos with titles. Please go around the room and write observations of each photo.

Also, please write down any questions that you have.



Gallery Walk- Share observations with your group



Gallery Walk- Scale of the Universe

Based on your prior knowledge and your observations of the photos, rank the following from largest to smallest.

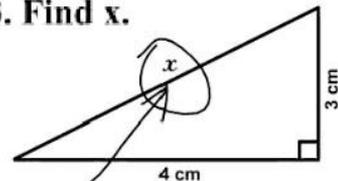
Carefully explain your reasoning for your ranking choice.



Ranking Task Exercises

- Students rank and **explain their reasoning**.
- Insight into student thinking rather than a memorized response

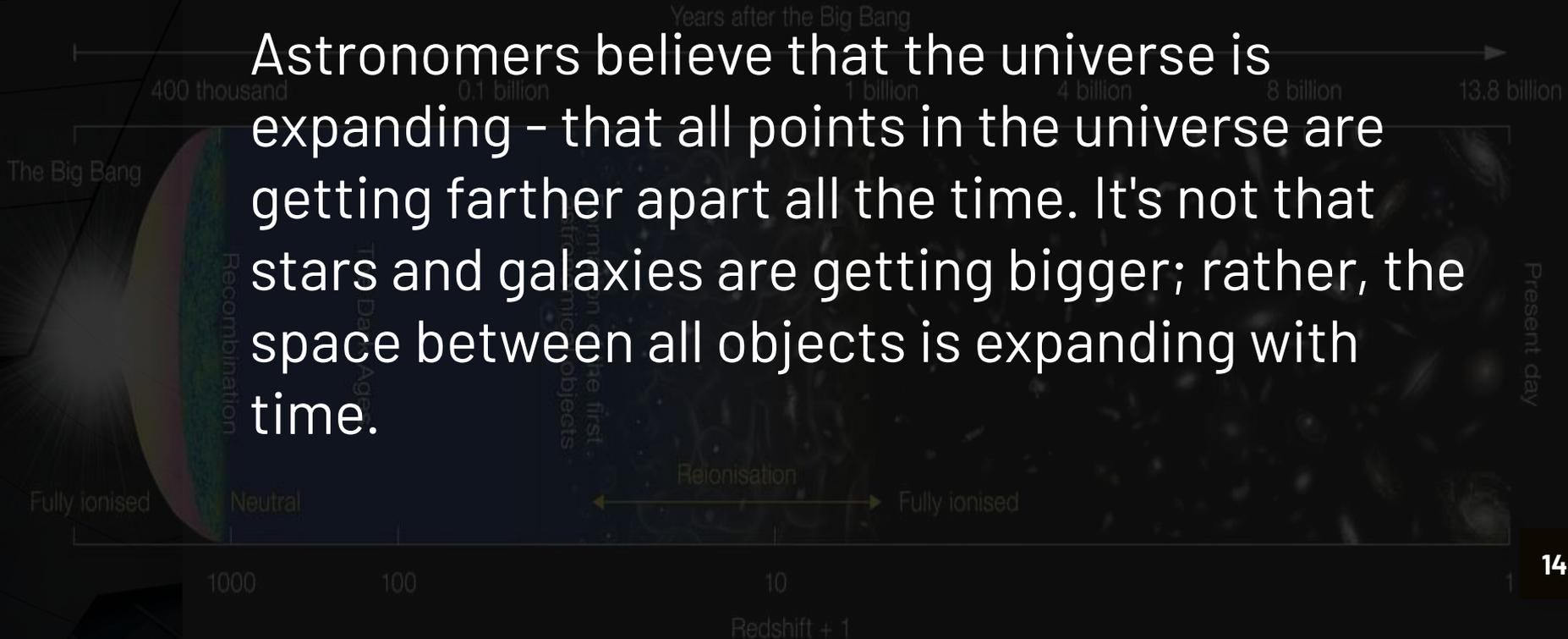
3. Find x .



Here it is

The Big Idea

Astronomers believe that the universe is expanding - that all points in the universe are getting farther apart all the time. It's not that stars and galaxies are getting bigger; rather, the space between all objects is expanding with time.





Quickwrite- What do you already know about this idea?

Astronomers believe that the universe is expanding - that all points in the universe are getting farther apart all the time. It's not that stars and galaxies are getting bigger; rather, the space between all objects is expanding with time.

What questions do you have about this idea?

Astronomers believe that the universe is expanding - that all points in the universe are getting farther apart all the time. It's not that stars and galaxies are getting bigger; rather, the space between all objects is expanding with time.

To start, we will work alone. See how many questions you can come up with. On your post-it notes, write down your questions (one per post-it).

What questions do you have about this idea?

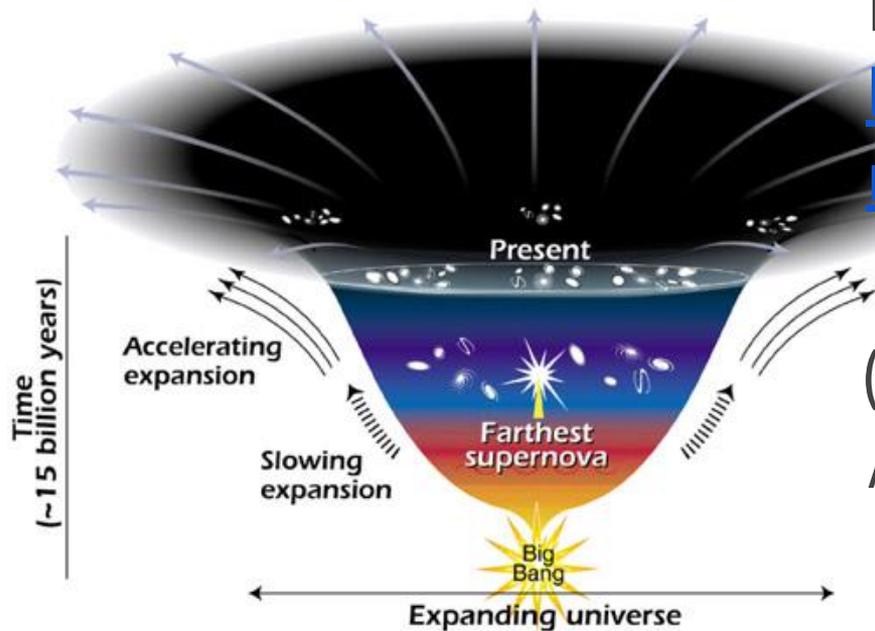
Astronomers believe that the universe is expanding - that all points in the universe are getting farther apart all the time. It's not that stars and galaxies are getting bigger; rather, the space between all objects is expanding with time.

Share your questions with your tablemates

Work with your table. Group similar questions together.

Bring your questions to the front board

The Expanding Universe - Simulation



Expanding Universe Model at <https://demonstrations.wolfram.com/TheExpandingUniverse/>

(follow along on GClassroom Assignment)

The Expanding Universe - Inverse Square Law Demo



Jet Propulsion Laboratory
California Institute of Technology

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DEMONSTRATION

Collecting Light: Inverse Square Law Demo



Technicians stow for launch a solar array on NASA's Juno spacecraft. Each of Juno's three solar arrays is 9 feet (2.7 meters wide), by 29 feet (8.9 meters long). Image credit: NASA/JPL-Caltech/KSC I + [Expand](#)

Activity Details

Subjects: [MATHEMATICS](#), [TECHNOLOGY](#)

Types: [DEMONSTRATION](#)

Grade Levels: [6 - 12](#)

Primary Topic: [MATHEMATICS](#)

Additional Topics:

[AIRCRAFT PROBES, SATELLITES AND/OR SPACECRAFT](#)

[EARTH AND SPACE SCIENCE](#)

[EARTH, MOON AND SUN](#)

[ENERGY](#)

[ENGINEERING AND TECHNOLOGY](#)

[MEASUREMENT](#)

[NUMBER AND OPERATIONS](#)

[PHYSICAL SCIENCES](#)

[PROBLEM SOLVING](#)

[SOLAR SYSTEM](#)

Time Required: Less than 30 mins

Overview

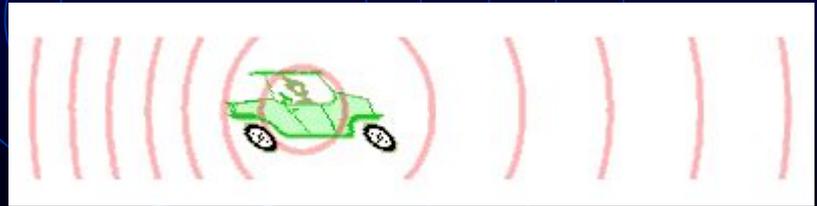
The Doppler Effect

What do you already know about the Doppler Effect?



Doppler Effect

- When a source and an observer (receiver) of waves are moving relative to each other, the observed frequency will be different from the frequency of the vibrating source.



static sound source

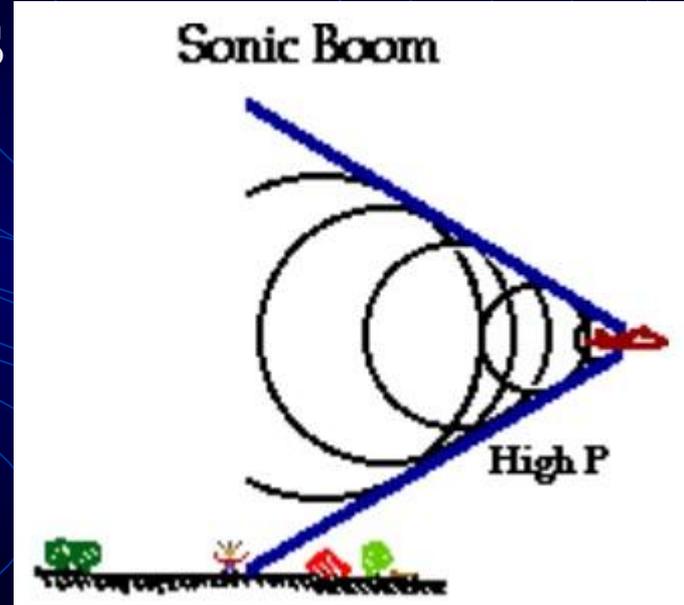


moving sound source



Doppler and Shock Waves

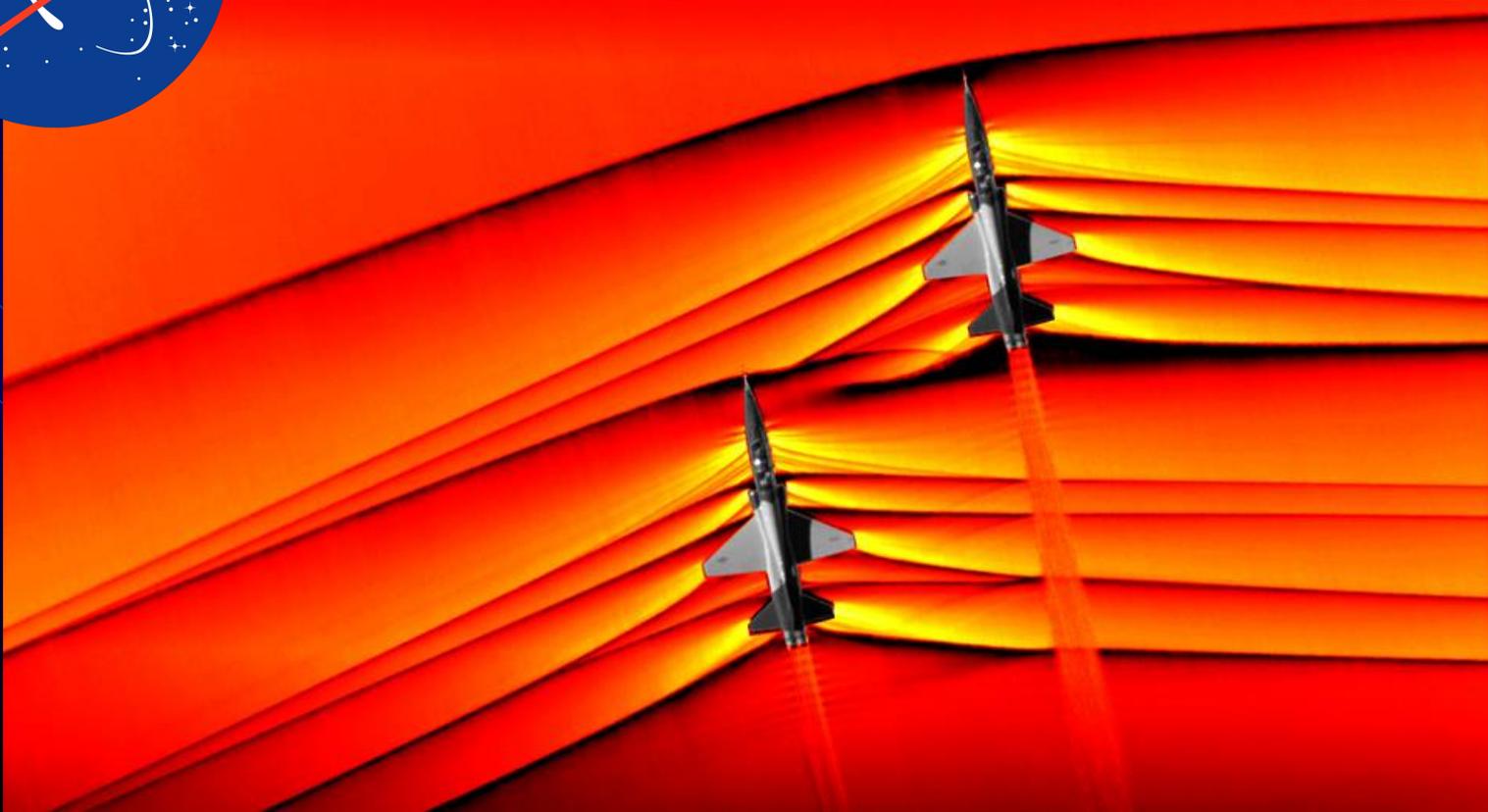
When a supersonic aircraft passes overhead, instead of the compressions and rarefactions being heard at separate times, they are heard at once. This creates a sonic boom.





Doppler and Shock Waves

NASA Supersonic Shock Wave



The Doppler Effect with light



Why do Astronomers believe that the universe is expanding? What is the evidence?

Fig. 1. (1st type: Sirius, Vega, Altair, Regulus, etc.)



Fig. 2. (2nd type: Sun, Pollux, Arcturus, Procyon, etc.)

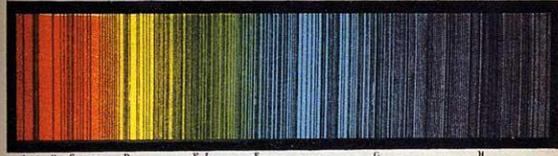


Fig. 3. (3rd type: α Hercules, β Pegasus, α of Orion Antares, etc.)

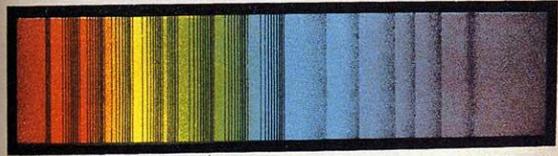
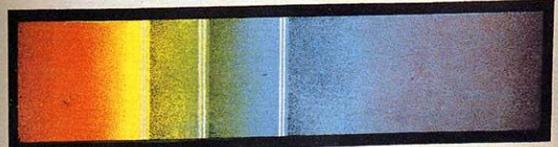
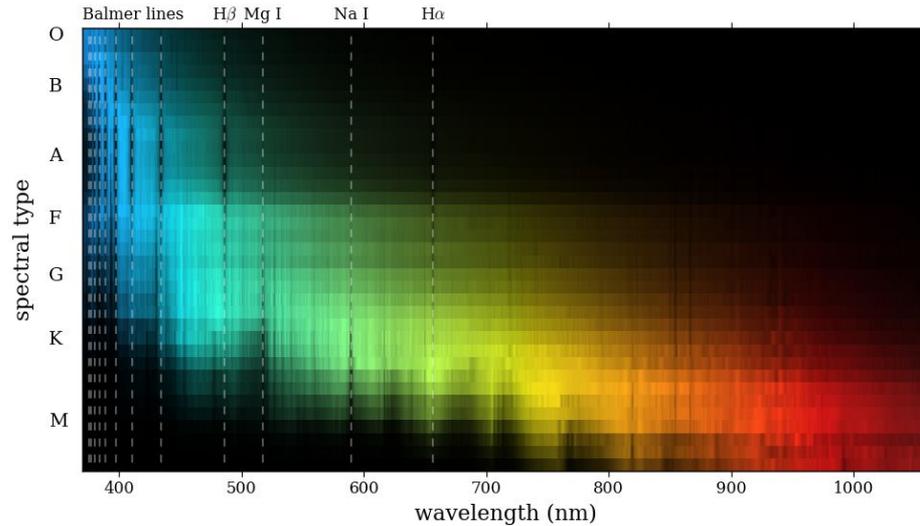


Fig. 4. (4th type: α of Schjellerup.)



We would now cover lessons on stellar spectra and review the composition of stars (covered in Chemistry).



NASA Spectrometer Activity for grades 6-12



Jet Propulsion Laboratory
California Institute of Technology

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CLASSROOM ACTIVITY

Using Light to Study Planets



By combining remote sensing technology and spectroscopy, scientists can make discoveries about features and trends on Earth (and other planets) that are not visible to the naked eye. This image of Western Australia was created using image data captured by the Landsat-8 satellite. Enhancing various portions of the image captured in different wavelengths and

Activity Details

Subjects: [SCIENCE](#), [ENGINEERING](#), [TECHNOLOGY](#)

Types: [CLASSROOM ACTIVITY](#), [EXPERIMENT](#), [MODEL](#)

Grade Levels: [6 - 11](#)

Primary Topic: [LIGHT AND OPTICS](#)

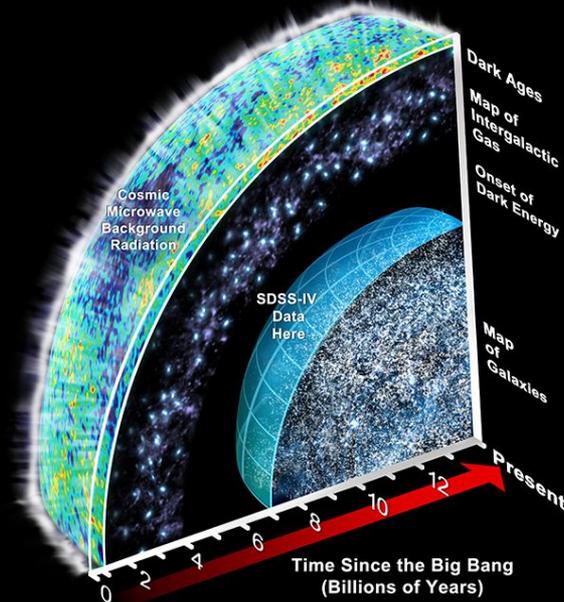
Additional Topics:
[EARTH AND SPACE SCIENCE](#)
[PHYSICAL SCIENCES](#)

Time Required: Longer than 2 hrs

Next Generation Science Standards
[\(Website\)](#)
[MS-PS-2](#)

What is the evidence that the universe is expanding?

SDSS-IV Catches the Rise of Dark Energy



Let's look at real data....

Sloan Digital Sky Survey (SDSS)

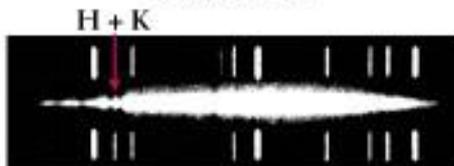
The Sloan Digital Sky Survey has created the most detailed three-dimensional maps of the Universe ever made, with deep multi-color images of one third of the sky, and spectra for more than three million astronomical objects.

GALAXIES in

REDSHIFTS



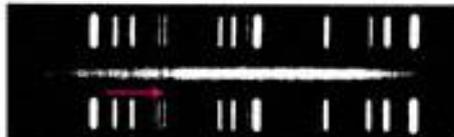
Virgo



1,200 km/s



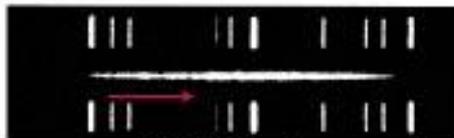
Ursa Major



15,000 km/s



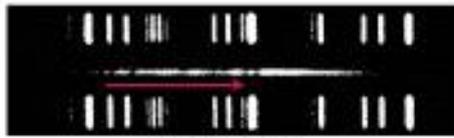
Corona Borealis



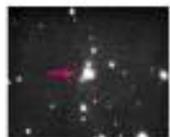
22,000 km/s



Boötes



39,000 km/s



Hydra



61,000 km/s

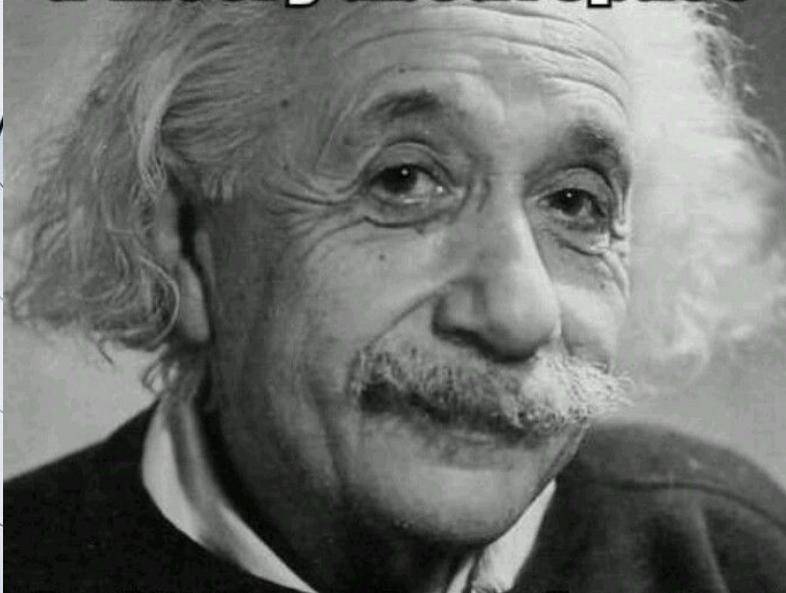


Scientists look at how the redshift of galaxies compare to its distance away.

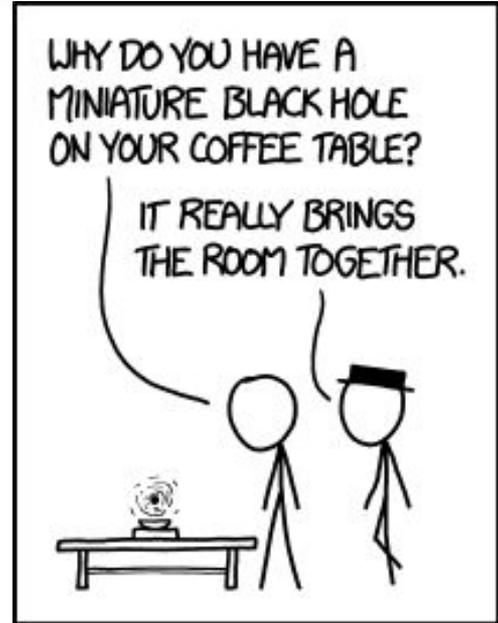
Today we will be collecting data from real galaxies and graphing it to look at relationships.

Space-Time

**Einstein developed
a theory about space**



And it was about time too



Gravity “Pi in the Sky Challenges” from NASA



Jet Propulsion Laboratory
California Institute of Technology

[Education](#)

| [Intern](#)

[Learn](#)

[Teach](#)

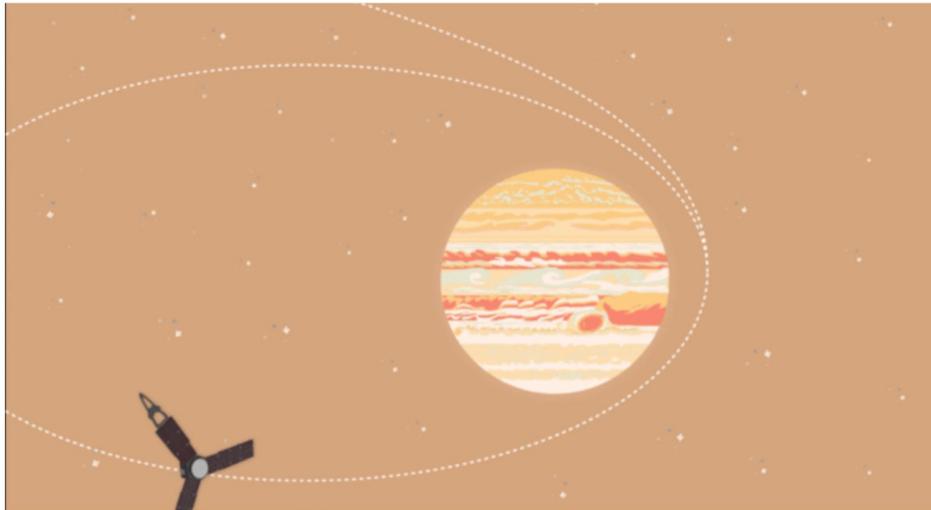
[News](#)

[Events](#)

[Share](#)

PROBLEM SET

Gravity Grab: A 'Pi in the Sky' Math Challenge



Activity Details

Subjects: [MATHEMATICS](#), [ENGINEERING](#)

Types: [PROBLEM SET](#)

Grade Levels: [9 - 12](#)

Primary Topic: [NUMBER AND OPERATIONS](#)

Additional Topics:

[AIRCRAFT PROBES, SATELLITES AND/OR SPACECRAFT](#)

[EARTH AND SPACE SCIENCE](#)

[ENGINEERING AND TECHNOLOGY](#)

[MATHEMATICS](#)

[MEASUREMENT](#)

[MOTION AND FORCES](#)

[PROBLEM SOLVING](#)



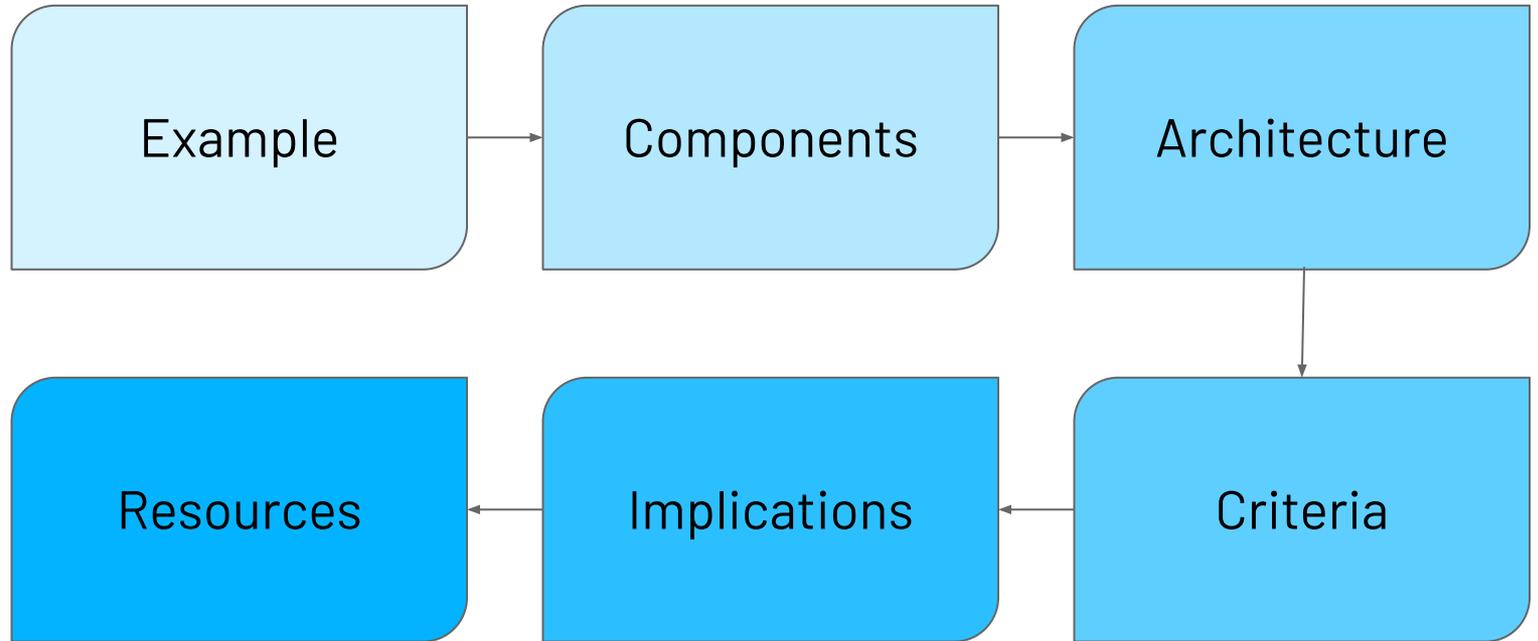
3D ASSESSMENT

Jenn will walk around with sign-in sheets after lunch.

PRE-CHECK

Place a dot to indicate your current confidence with the following objectives related to assessment (first row of each poster).

1. I understand the essential components of a three dimensional NGSS-aligned assessment.
2. I am familiar with the architecture of a quality 3D NGSS assessment.
3. I can use the NGSS Assessment Prescreen red flag checklist on a sample assessment to determine its three dimensionality.
4. I can identify implications of assessment shifts for teaching and student learning.
5. I am familiar with where to find assessment resources.



EXAMPLE ASSESSMENT

Examine the assessment example.

- How might this assessment differ from more “traditional” assessments on this topic?
- Highlight evidence for the three dimensions.
 - ◆ SEPs
 - ◆ CCCs
 - ◆ DCIs

ASSESSMENT COMPONENTS

- NGSS assessments should address all three dimensions (SEPs, DCIs, and CCCs) of a performance expectation.
- It is uncommon for a single question to do this on its own. Individual questions typically address 2 dimensions (such as an SEP and DCI or CCC and DCI).
- Well-crafted NGSS assessments present a scenario that is followed by multiple questions that together create a 3D picture of what students know and can do.

To what degree was the example assessment able to do this?

ASSESSMENT ARCHITECTURE

PHENOMENON

The phenomenon should welcome students into the question. A good phenomenon will make the assessment approachable for all students. Use a unique phenomenon that addresses the same scientific concepts as other phenomenon used within the course to show transfer of knowledge.

STIMULUS

The stimulus may contain data, models, graphs, maps, lab setups, text, etc. A rich assessment will contain multiple stimuli. All of the information required to answer the prompts must be included in the assessment. Distracting stimuli may be included to discern students knowledge of the standard.

PROMPT

Prompts should assess student knowledge while pointing the way to a proper response. Sentence frames to support student use of practices and crosscutting concepts can be found at [Bozeman's The Wonder of Science](#).

Where is there evidence of the use of this architecture in the example?

ASSESSMENT CRITERIA

NGSS and Achieve developed an Assessment Task Prescreen.

1. What is the purpose of the [screeener](#)? How might teachers use it?
2. Use the screener (p. 2) to evaluate the example assessment task.
3. Compare your results with a partner.

ASSESSMENT IMPLICATIONS

Select one of the following and discuss with a partner.

1. What about the shifts in assessment that accompany NGSS strikes you as most significant for students?
2. What potential benefits do these types of assessments bring to your teaching practice?
3. What are the implications of these types of assessments for teaching and learning?

ASSESSMENT RESOURCES

- [JPL NASA Activities](#)
- Concord Consortium's [Next Generation Science Assessment](#) (Middle School) and [Interactions](#) (High School)
- [Stanford SNAP Assessments](#)
- [The Wonder of Science \(formerly Bozeman\) Performance Assessments](#)
- [Sample and Practice CAST Test & Scoring Guide](#)
- [Essential Learning Events Assessment Task Prompts](#)
- Illuminate
- Collection of assessment resources on [District Science Page](#)

POST-CHECK

Return to the wall posters and place a dot to indicate your current confidence with the following objectives related to assessment.

1. I understand the essential components of a three dimensional NGSS-aligned assessment.
2. I am familiar with the architecture of a quality 3D NGSS assessment.
3. I can use the NGSS Assessment Prescreen red flag checklist on a sample assessment to determine its three dimensionality.
4. I can identify implications of assessment shifts for teaching and student learning.
5. I am familiar with where to find assessment resources.



LESSON DEBRIEF

Participants should use this [Template](#) to record ideas

Google Classroom Benefits

Add assignments- Option to make a copy for each student. Copies are automatically named and filed

Assignments can be scheduled for different times

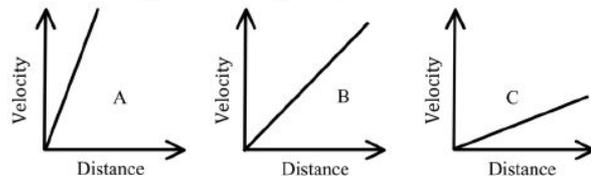
You can see student progress at anytime

Easy to grade, can score and send to Aeries

Ranking Tasks



Description: The following ranking tasks refer to the series of Hubble plots (A-C) shown below. Each Hubble plot depicts a different possible universe. Use the information provided in these plots to reason through each ranking task provided below.



A. Ranking Instructions: Rank the expansion rate (from fastest to slowest) that each universe would be experiencing.

Ranking Order:

Fastest _____, _____, _____ Slowest

Or, the expansion rate is the same for each universe _____ (indicate with a check mark).

Carefully explain your reasoning for ranking this way:

B. Ranking Instructions: Rank the average distances (from smallest to largest) between the galaxies in each universe for the particular case in which they all started at the same time and have been in existence for the same amount of time.

Ranking Order:

Smallest _____, _____, _____ Largest

Or, the average distances are the same for each universe _____ (indicate with a check mark).

Carefully explain your reasoning for ranking this way:

C. Ranking Instructions: Now rank the age (from oldest to youngest) of each universe based on the amount of time it would have taken each universe to reach a particular size.

Ranking Order:

Oldest _____, _____, _____ Youngest

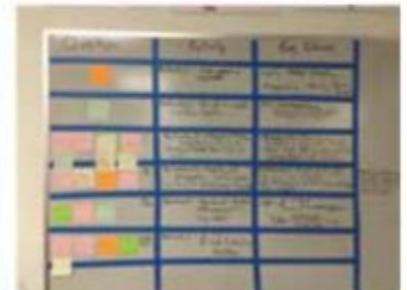
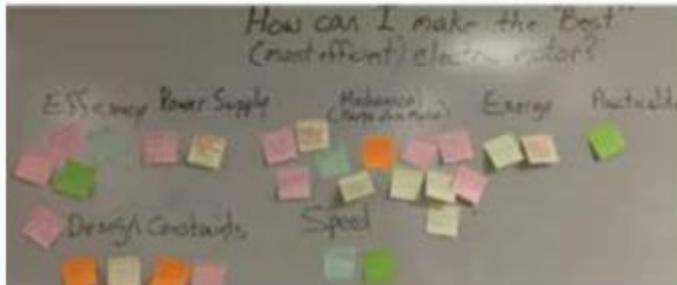
Or, the age is the same for each universe _____ (indicate with a check mark).

Carefully explain your reasoning for ranking this way:

Driving Question Board

Activity Summary Board- NSTA

The unit moves from (left to right) the driving question board (DQB) through unit investigations to the activity summary board (ASB).



LESSON CONTEXT



- NGSS Evidence Statements
- Participants record ideas in [Template](#)

THREE KEY FINDINGS



Participants identify how the [three key findings](#) of *How People Learn* were incorporated in the lesson:

1. Accessing prior knowledge
2. Building conceptual framework
3. Metacognition

Participants record ideas in [Template](#)

ESSENTIAL LEARNING EVENTS



Participants identify:

- Any Essential Learning Event(s) experienced during the lesson
- Specific Sample Student Actions/Teacher Actions for those Essential Learning Events as evidence

Participants record ideas in Template

NGSS LESSON SCREENER (OVERVIEW)



PURPOSE OF SCREENER

1. Quickly review lesson to see if it is on the “right track”
2. Determine if lesson warrants further review
3. See if group of reviewers have understanding of NGSS and lesson design

ARCHITECTURE

6 Criteria:

- A. Explaining Phenomena
- B. Three Dimensions
- C. Integrating 3D
- D. Relevance & Authenticity
- E. Student Ideas
- F. Building on Prior Knowledge

[Link to NGSS Lesson Screener](#)

NGSS LESSON SCREENER (APPLICATION)



- Facilitators or group choose one Criteria
- Individually, participants complete Items 1 and 2 of Criteria on the [screener](#).
- In small groups, participants complete Item 3 of the lesson screener.

SUGGESTIONS FOR IMPROVEMENT



Discuss in small groups. Be prepared to share out with whole group.

In addition to the suggestions noted in Item 2 on the Lesson Screener, how else might the lesson be improved?

LEARNING OBJECTIVES



1. Identify which Learning Objectives were addressed
2. Is the lesson within assessment boundaries? Why or why not?
3. Discuss any Learning Objectives that were not addressed; is there an opportunity to include them?



APPLY LEARNING

(1:15 - 2:15 pm)

APPLY LEARNING (CHOOSE ONE OF THE FOLLOWING)

CONTINUE DEBRIEF WITH FACILITATORS

Teachers are welcome to speak with facilitators to deepen their understanding of the shared lesson/assessment

BUILD LESSON INTO YOUR COURSE

Teachers incorporate the lesson/assessment into their course Scope and Sequence

ADAPT/SHIFT LESSON OR ASSESSMENT

Teachers apply learning from today's lesson/assessment to build a lesson or assessment of their choice

Be prepared to share out what you have worked on at session's end.



WRAP-UP

(2:15 - 2:30 pm)

Remind Teachers to Sign Out in main room at 2:30 pm



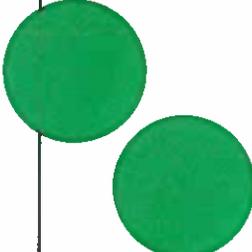
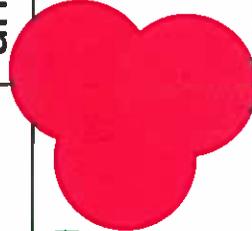
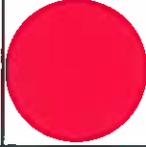
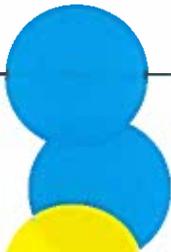
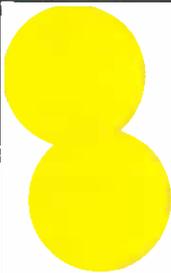
THANK YOU!

Please complete the
Post-PD Survey

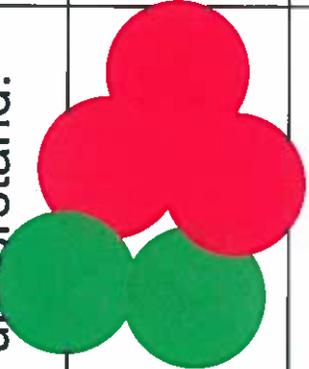
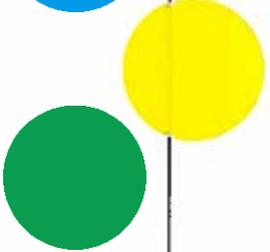
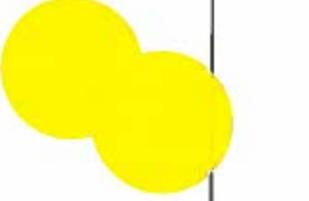
Remind Teachers to Sign
Out at 2:30 pm in the PAC
on their way out (sign out
with Vicki)

Physics

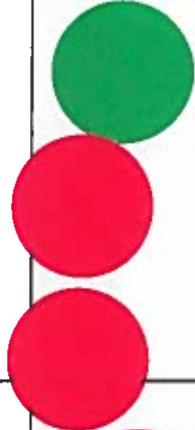
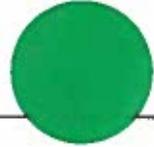
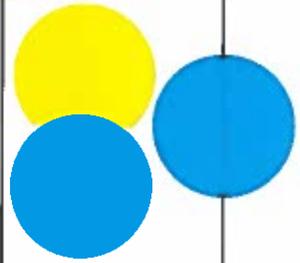
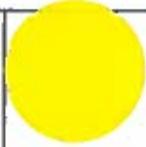
1. I understand the essential components of a three dimensional NGSS-aligned assessment.

	I am starting at Square One.	I am starting to understand.	I have a pretty good understanding.	I totally get this!
Pre-✓				
Post-✓				  

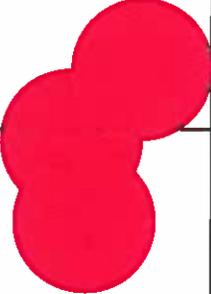
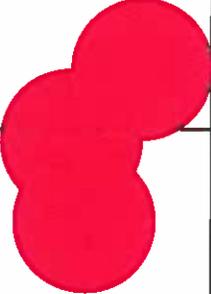
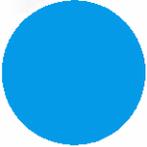
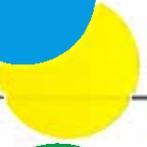
2. I am familiar with the architecture of a quality 3D NGSS assessment.

	I am starting at Square One.	I am starting to understand.	I have a pretty good understanding.	I totally get this!
Pre-✓	<p>I am starting at Square One.</p> 	<p>I am starting to understand.</p> 	<p>I have a pretty good understanding.</p> 	<p>I totally get this!</p>
Post-✓				

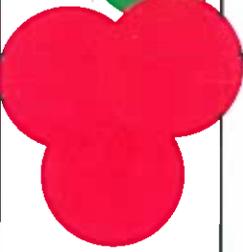
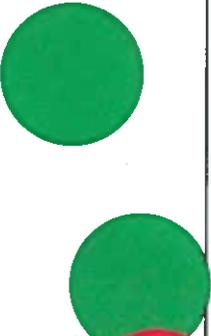
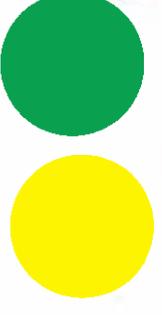
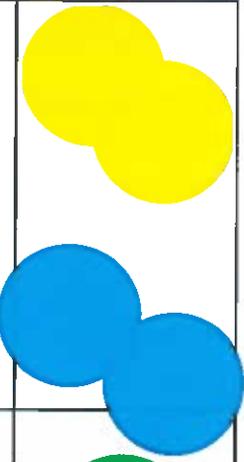
3. I can use the NGSS Assessment Prescreen red flag checklist on a sample assessment to determine its three dimensionality.

	I am starting at Square One.	I am starting to understand.	I have a pretty good understanding.	I totally get this!
Pre-√				
Post-√				

4. I can identify implications of assessment shifts for teaching and student learning.

	I am starting at Square One.	I am starting to understand.	I have a pretty good understanding.	I totally get this!
Pre-√		 	 	
Post-√			  	  

5. I am familiar with where to find assessment resources.

	I am starting at Square One.	I am starting to understand.	I have a pretty good understanding.	I totally get this!
Pre-√				
Post-√				

Bryn Bishop
SCED 545
Spring 2019

NASA Endeavor STEM Leadership Seminar

FINAL REPORT

XII. Names and contact information of five educators who attended the PD.

Mercer Barrows mercerc.barrows@sduhsd.net

Ryan Cardenas ryan.cardenas@sduhsd.net

John Danssaert john.danssaert@sduhsd.net

Will Harvie william.harvie@sduhsd.net

Katie Stapko katie.stapko@sduhsd.net