

BEAD 2: Galaxies (and our own Milky Way)

MATERIALS (STANDARD) FOR EACH CLASS:

- Copies of the 1-page **list of 28 events** (for each child to use during class)
- The **Storyboard Box**
- The **Picture Box** containing the class drawings (if you choose that approach)
- **Beads Box** that contains labelled bags of the extra beads from prior weeks
- **Clear tape** for affixing the bead to the first square in the matrix

MATERIALS FOR THIS SESSION:

- (Optional) Large space photo of [Andromeda Galaxy](#) and [merging galaxies](#)
- Slip of paper with this url that depicts the 13 satellite galaxies of the Milky Way:
<http://www.atlasoftheuniverse.com/sattelit.html>
- Choose in advance one of 2 approaches for acting out “How Milky Andromeda Will Form”, depending on space constraints. **Option A** involves the whole class in movement and requires a **lot of open floor space** (indoors or outdoors). It also requires you to make in advance **2 black paper circles** (approx 6 inches), with string to hang around kid’s necks and to represent the Supermassive Black Hole at the center of each galaxy. **Option B** involves only 2 volunteers in movement, but it doesn’t require any space beyond a normal classroom. Option B requires you to bring **2 dinner (or paper) plates** to class.
- **Beads in a Sock** chosen or made to represent **galaxies** (they can all be the same).
- Materials to create **Black “scratchboards”** (for kids to scratch out drawings of galaxies and stars the *next* week): **sturdy white paper** or posterboard, **crayons**, **black spraypaint**, **newspaper** to protect spray area and to spread over tables so that the sprayed paper can dry safely there.

MATERIALS FOR NEWCOMERS:

- The 1-page **list of 28 events** (to take home)
- Blank **Storyboard** with the 28-event Matrix already glued on (write their name on it)
- **Beads Box** containing beads for all the events discussed thus far.

PREPARATION NOTES:

Go online and visit the url (above) of the **13 satellite galaxies of the Milky Way**. Practice the exercise on page 6, “**Sagittarius Dwarf Hand Exercise**”, so that you lead children through this in class. The **slip of paper** is to give to a volunteer after the exercise who wants to research how Sagittarius Dwarf is right now being “eaten” by the Milky Way and to report back to class next session.

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|---------------------|--------------------|---------------------|--------------------|----------------------|------------------|------------------|
| 1. Great Radiance | 2. Galaxies | 3. Stars / stardust | 4. Sun | 5. Earth & planets | 6. Earth's moon | 7. Rain & oceans |
| 8. Life begins | 9. Sea animals | 10. Plants on land | 11. Amphibians | 12. Insects & flight | 13. Trees / wood | 14. Dinosaurs |
| 15. Reptiles in Sea | 16. Meteor/Extinct | 17. Turtles | 18. Little mammals | 19. Primates | 20. Grass | 21. First humans |
| 22. Ice Age / fire | 23. Dogs adopted | 24. Cats adopted | 25. Horses adopted | 26. Cities / reading | 27. I am born! | 28. My future? |

REVIEW OF PRIOR WEEK (PARTICIPATORY; CIRCLE RECOMMENDED):

Who was here last week?

Who wants to help us remember what we talked about and did last week?

Encourage discussion (topics: name choice for birth of Universe; what a Bead Storyboard is; why we use beads to represent events; how we each chose a bead)

Did anyone try to learn what the scientific evidence is that the Big Bang really happened?

NEWCOMER CATCH-UP TIME

1. If you have ANY NEWCOMERS, everyone begin by sitting in circle. Then ask for volunteers (“**Which Earthling will volunteer . . .**”) to bring these things to circle center: Storyboard Box, extra storyboards, Beads Box, clear tape, marker pen.
2. Ask another volunteer to pass out a copy of the 28-events list to everyone in the circle.
3. Introduce the Newcomer children.
4. Assign the least-participatory children each of these tasks, in sequence:
 - Give [NEWCOMER NAME] a blank Storyboard.
 - Help [NEWCOMER NAME] select a bead for the event(s) they missed.
 - Show [NEWCOMER NAME] an example of a Storyboard with bead(s) taped on, so they can see where to tape their new bead(s) on.
 - Give [NEWCOMER NAME] a marker pen so that they can write their name on the Storyboard.

STORYTELLING (PARTICIPATORY; CIRCLE RECOMMENDED):

PART 1: In the Beginning

This is the Universe Story that belongs to all Earthlings.

Who here is an Earthling? . . .

In the beginning, about **13.7 billion years ago**, our Universe was born. Nobody yet has discovered *why* our Universe was born. But **scientists** have discovered lots of **evidence** that our Universe really did have a beginning, and that the beginning happened suddenly

more than 13 billion years ago. So . . . just like us . . . the Universe came into existence by **being born**.

Scientists have discovered that after the Universe was born, it grew from something smaller than a **toadstool**, smaller than a **shrimp**, into something so immense that it now contains billions of **galaxies**. We also know that the Universe is still growing. It is still growing, just like you are still growing.

The Story of the Universe is actually **your story**. It is the story of who all your ancestors and cousins are — not just your human ancestors and cousins, but also the great-great-great-great-great grandparent you share in common with a **raccoon**, and with the even older common ancestor you share with a **frog**, all the way back to when the only creatures alive on planet Earth were **bacteria**. The wonderful thing is that this story is exactly the same story for all the children born on this planet.

Last time we learned that the birth of the Universe is known by different names. Scientists call it the **Big Bang**. Others call it **The Great Radiance** or some other name.

So what event are we going to choose a bead for today?

Clue: Look at your list of events

*Answer: **Galaxies** form, and small galaxies merge into bigger galaxies (like our Milky Way).*

PART 2: Galaxies Form

Apparently **Dark Matter** played a very important role in helping **galaxies** to form. Scientists still don't know what **Dark Matter** is, but they know it must exist because something was needed to provide enough **gravity** to help the stuff of the Universe clump into **galaxies**. Think about a **firecracker** exploding.

Who has seen a Fourth of July fireworks display at night?

Encourage a show of hands, and maybe brief stories.

Now imagine that the bright bits of **fireworks** in the sky never stop exploding outward; they never fall back to Earth. Those pieces would just keep going farther and farther out, and so they keep getting farther and farther away from one another. They wouldn't ever clump back together. But in our Universe, after the explosion of the **Big Bang**, clumps actually did form, and we call those clumps **galaxies**. Scientists think that **Dark Matter** used its gravity to bring the clumps back together into actual galaxies.

But **no scientist knows what dark matter really is**. Maybe a **future scientist** who is your age right now will figure that out — or maybe one of you will. . . .

Do any of YOU think you might some day like to become a scientist?

PART 3: Our Milky Way Galaxy

So what is the name of our own galaxy?

Answer: The Milky Way. Our Sun is one of the stars that make up the Milky Way.

How many stars are in the Milky Way?

Answer: More than 100 billion stars. That makes our galaxy a very big galaxy.

Galaxies form into different **shapes**. Some have their stars all packed into a shape that is **spherical**, like a soccer ball or a planet. Others look from a distance like a **hard-boiled egg**, and they are called “elliptical”.

Does anyone know what scientists call the shape of our Milky Way Galaxy?

*Answer: It is a **spiral galaxy**.*

Our Milky Way Galaxy is a **spiral galaxy**. That means it looks kind of like a **fried egg** — sort of flat, but with a thicker yolk in the center.

PART 3: Galaxies Eat Other Galaxies

Our **Milky Way Galaxy** began to form soon after the birth of the Universe. **Dark Matter** helped clump together the simplest atoms in the early Universe. But even beyond that time, our Milky Way Galaxy has been growing bigger.

It grew bigger mostly by **gobbling up smaller galaxies**. Its bigger size meant it had more **gravity**, so it could pull those galaxies in. And this process of eating smaller galaxies is **still happening!**

Our **Milky Way** right now **is consuming** a very small galaxy, which scientists call a “**dwarf galaxy**.” They call this little galaxy the “**Sagittarius Dwarf**.” This **fact** was discovered only very **recently**: in 1994. It took that long for astronomers to discover what was happening because the galaxy being consumed is so **tiny**, and because to see it astronomers **have to look right through all the stars in the center** of our galaxy. This is because the Sagittarius dwarf galaxy is located on the **exact opposite side** of the Milky Way as we are. We can **use our hands** to understand why Sagittarius Dwarf was so difficult for astronomers to discover.

“Sagittarius Dwarf” Hand Exercise: Teacher Instructions

Model for students how to put out a **hand flat with palm up**. This is our Milky Way. The center of our Galaxy is the center of the **palm**. Our solar system is located on the **middle segment of our pinky**. The Sagittarius Dwarf Galaxy is being sucked through our **thumb**. Astronomers have to look through all the stars between these points, that would be the flesh of our hand.

I have a **slip of paper** here with the **website address** for learning more about the **Sagittarius Galaxy**. This website also tells about **all of the little galaxies** that slowly orbit our big Milky Way Galaxy, kind of the way that planets orbit our Sun.

I need a volunteer to go online and research this, and then tell us about it at our next session . . .

Choose one person to give the slip of paper to. [If more volunteer, assure them that in a few minutes there will be other opportunities to volunteer to do research.]

PART 4: A Gigantic Merger to Come

You would have to travel a lot farther out from our Milky Way before you would encounter a **galaxy as big as ours**. Such a galaxy has its own set of smaller satellite galaxies orbiting slowly around it, and it is also in the shape of a spiral.

Does anybody know the name of this galaxy?

*Answer: The closest one to us is **Andromeda**, and it is maybe a bit bigger than ours.*

Optional: [Show photo of Andromeda Galaxy]

Now here is something really **amazing**: Scientists have measured how the **Milky Way** is moving through the Universe, and how **Andromeda Galaxy** is moving, and they have calculated that in about **3 billion years** — a long, long time from now — Andromeda and the Milky Way are going to begin to **merge**!

Who thinks that's exciting? . . .

Some scientists have suggested that the single galaxy that this **merger** will produce should be called, “**Milky Andromeda**”.

What do you think? . . .

Optional: [Show Hubble photo of the merging galaxies, called “The Mice”]

Who wants to research and report next session as to what evidence there is that the Milky Way and Andromeda are actually moving toward one another?

Note to Teacher: A simulation of Andromeda merging with Milky Way is on YouTube, under the title [“Spiral Metamorphosis”](#). Also, [“Andromeda/Milky Way Collision”](#)

Who wants to research and report back next session what mythological story the word “Andromeda” comes from?

MOVEMENT ACTIVITY A: HOW “MILKY ANDROMEDA GALAXY” WILL FORM

TEACHER DIRECTIONS: Materials: **two black hole circles with string**. This involves the **entire class** in movement and requires a **large open floor space**, indoors or out. *If you don't have sufficient space, choose Movement Activity B instead.*

- (1) Divide the kids into 2 teams. Assign one as **Milky Way Galaxy** and the other as **Andromeda**.
- (2) **Choose someone on each team** and **drape the “black hole” circle** over their neck. Announce that these individuals are each the **“Supermassive Black Hole”** at the **center** of each galaxy.
- (3) Direct the **Supermassive Black Holes to remain stationary** while the rest of their team members are **stars that orbit *slowly*** about the center — all going in the same direction.
- (4) Direct the **2 Supermassive Black Holes to begin walking toward each other**, very slowly. Meanwhile, **the rest of the team members** must keep orbiting and adjust their orbits to keep their black hole at the center.
- (5) As the **outermost stars near one another**, announce that distances between **stars** are so great that they will **NEVER CRASH** into one another. But the stars begin to feel the effects of the other galaxy's **gravity**, so they sometimes get **jostled** a little out of their regular orbits.
- (6) The **Supermassive Black Holes stay on course**, directly toward each other. Ultimately they will **join into one Superdoooper Supermassive Black Hole**. Meanwhile their **stars** slosh around and take awhile to **reestablish regular orbits** around the new **“Milky Andromeda”** galaxy.

MOVEMENT ACTIVITY B: HOW “MILKY ANDROMEDA GALAXY” WILL FORM

TEACHER DIRECTIONS: **Materials:** 2 dinner (or paper) plates. *Do this activity only if you don't have sufficient space to do Movement Activity A.* Ask for **2 volunteers**: one to be the **Milky Way** and the other to be **Andromeda**.

“Scientists calculate that these **two spiral galaxies** are about the same size. Each is about **100,000 light years** across. That is huge! A single light year is the distance that light travels in a year, at the speed of 186,000 miles per second. So a galaxy that is 100,000 light years across is **humungous**. Scientists also calculate that **Andromeda** is about **2.5 billion light years away from us**. So that means that the distance between the two is about **25 times greater** than the diameter of the Milky Way.

“So, let's **ask our two volunteers** to find places in the room where they are about **25 times farther apart** than the width of the plate they are holding. . . .

[Wait for the two volunteers to settle on places to stand.]

“Now let's ask our volunteers to **slowly move toward** one another — toward a galaxy merger. And please know that **the galaxies do not crash!** There is so much room between each of the stars in the galaxies that the plates will not even touch. We will just **pretend** that the **two galaxies dance** through each other — back and forth, like a **swing** slowing down, finally coming to rest as a **single gigantic galaxy**.

ACTIVITY: CHOOSING THE NEXT BEAD (GALAXIES)

TEACHER DIRECTIONS: Return to circle. Pass around the **sock** with the **Galaxy beads** in it. Let the kids know if all the beads are the same. If there are a variety of beads, then instruct the kids to choose a bead by feel — no peeking!

ACTIVITY: ADDING THE NEW BEAD TO THE STORYBOARD

TEACHER DIRECTIONS:

1. Stay in circle and ask for a **volunteer** to go to the circle center to the **Storyboard Storage Box** and one-by-one pull out a **Storyboard** and **read aloud the name**. Ask for **another volunteer** to carry each Storyboard to its owner.
2. When all Storyboards are handed out, instruct the kids to go to a table or stay on the floor to **tape their bead** onto their storyboard: their choice.

CRAFT ACTIVITY TEACHER DIRECTIONS: CREATE SCRATCHBOARDS

“This is a **2-week project**. First, we create the black scratchboards, and next week we use them to **etch galaxies and stars** into them.”

Step 1: Write your **name** on the **BACK** of the sturdy white paper/posterboard.

Step 2: **Color** the whole front surface using **CRAYONS**. Just fun patterns, as we are going to then **spraypaint** it **black** so that **next week** when we **etch in galaxies and stars**, the crayon colors will show through. Use mostly the **colors** that stars actually come in: **WHITE, YELLOW, RED, ORANGE, and BLUE**. We’ll learn more about star colors next week.

Step 3: When you finish coloring, go to the **spraypaint station**. (*Make extras for kids who missed this week.*)

Step 4: Carefully move the painted paper to a drying table covered with newspapers.



Photo above is an example of a child’s using the scratchboard to depict a galaxy. (The final step of scratching the black paper happens in next week’s lesson.) Marge Gonzalez used “My Universe Story” curriculum in 2012-13 for the children’s program at the Unitarian Universalist Church of Ft. Myers (Florida).

AT CLASS END: Request children to put their storyboards into the **storage box**.

“So what event will we be doing next week?” [look at list]

Did anyone volunteer today to research a question and report back next week [or later this week]?

If anyone has, or wants to borrow from the public library, any pictures or picture books of galaxies, please bring it with you next time, so that you can show all of us some pictures, and then we can scratch out our own pictures of galaxies on the black scratchboards we made today.

TEACHER NOTE: **Closing Song** (This will be sung at the end of every session. Click here to listen to [AUDIO](http://thegreatstory.org/audio/child-of-the-universe.mp3).) <http://thegreatstory.org/audio/child-of-the-universe.mp3>

CLOSING SONG

I am a child of the Universe.

You are a child of the Universe.

We are all one.