Cosmic Lighting

New Mexico Adventures in Supercomputing Challenge
Final Report
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Team #42
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Executive Summary

We have made a model that tests our theory on how lightning is started and what makes it spark. Our theory is that when a cosmic ray from an exploding star enters our atmosphere and passes through the molecules it will create a spark that will lead to a lightning bolt. The charge will travel from a energized point-in space to another point-in space. Mr. Raloff suggested that there is another factor which acts like a quantum clock. Our theory is that if a molecule is at a certain position, it will send the energy from that point-in space to another. A lightning bolt contains a huge current that makes it a deadly phenomenon.

Introduction

For billions of years lightning has existed and not one truly knows how lightning is started or what generates lightning. Our goal is to make a model representing our theory on how lightning is started, showing how the molecules movement, properties and reactions to each other as they generate lightning.

We produced a beginning model in Star Logo. Through Star Logo we hope to finish a successful model of our theory. There is still the showing of the lightning bolt between these points to create the lightning strike, then we can make each of the steps more realistic.
We have colliding molecules of gas, the background change and the introduction of a cosmic ray striking a molecule done. We have modeled that energy moving to various points to a random ‘quantum’ clock.

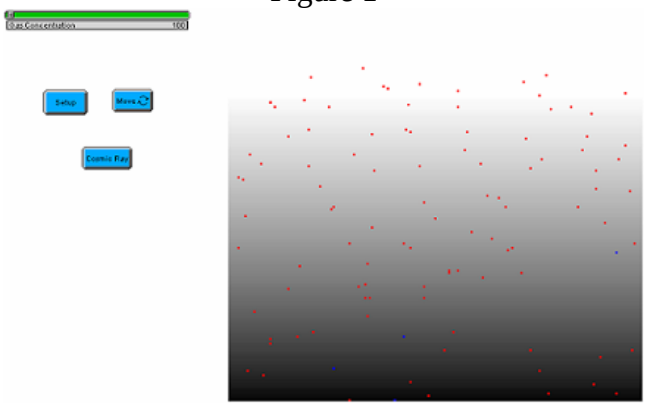
Description

We have created a Star Logo model that shows the inside of a cloud and how the molecules move about. There are some molecules moving faster than others, we did this to add realism to our model. With a click of a button cosmic rays are formed throughout the model, the cosmic rays pass through by the molecules creating a point with a large energy charge. When this happens the cosmic rays help form a lightning strike that travels through the path to a point with the same quantum setting. In the model there are sliders that change the energy or speed, and concentration of the molecules. We hope to complete a detailed presentation of a lightning strike.

Results

After studying lightning and producing a model in Star Logo we found our model ended up doing just what we wanted, it created the molecules, made some move faster then others by adding energy levels, and the quantum clock works (figure 1). Making the final showing of a lightning bolt is the next step. Having each of the steps in the process be more physically realistic will go towards making a more specific model of lightning.

Figure 1



Appendix A

Starlogo – Turtle Proceedure

```
turtles-own [speed energyt] ; gives the turtles a speed and energy for movement

to go ; moves the turtles randomly arround for a more realistic model.
set energyt random 500 ; gives turtles a random energy for movement
fd (energyt) ; turtles move only as far as they can with there ammount of energy
check-patches ; calls up another function

end
to check-patches
if count-turtles-here > 1 ; asks if there is any turtles on the patch
[seth random 360 ; if yes then  the two turtles bounce off each other
setenergyt random 500 ; each turtle that collided and bounced off are now set with more energy to move.
]
end
```

Apendix B

Starlogo – Observer Proceedure

```
patches-own [energy quantum]

to setup        ; begins the process of creating turtles
ca       ; clears graphics, turtles, and previous commands.
create-turtles-and-do many [setx random screen-width sety random screen-height seth random 360 setc red] ; creates turtles and places them in a random patch with a random heading
ask-patches [setpc ycor / 15 + 5] ; sets backgound with tints according to the charge. the small equation represents the strech and fit of the patch color.
ask-patches [set energy (random 10 + 1)] ; sets patches with the variable energy for cosmic ray charge.
ask-patches [set quantum random 5000] ; sets patches with the variable quantum for cosmic ray and particle connection.
end

to zap ; Creates the cosmic ray and controles the connection between them.
ask-patches [set energy-at 0  73  1000]  ; places cosmic ray on a patch for further connection.
ask-patches [
        if quantum = quantum-at 0 73 [    ; looks for a turtle with the same quantum number as it self and begins the connection between the particles.
                  if pc   < pc-at 0 73          ; makes sure the cosmic ray doesn't travel up but forces it down.
                        [setquantum quantum-at 0 70
                              ;setenergy 1000
                        setquantum-at 0 73 random 5000 ; random parameter relecting "quantum" clock
                              ;setenergy-at 0 73 random 10
                        setpc blue] ; sets patches blue that the cosmic ray affects.]
]
end
```

References

Glencoe Physics Principles and Problems
(Glenco / The McGraw-Hill Companies 1999)

Jeffory Raloff

- Physics, Math, Chemistry teacher
- Mentor

Trevor Malik

- Mentor

http://en.wikipedia.org/wiki/Lightning

- Explained how part of the current is caused by friction

www.pbs.org/wgbh/nova/sciencenow/3214/02

- Explained the theory of cosmic rays to create lightning

http://science.howstuffworks.com/lightning3

- Described in detail what happens in the electric field in a cloud