

# Teaching Science with Science Fiction

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Laura McCullough

# Introductions

- Kelly: author, professional communicator
- Laura: professor, professional teacher







# Welcome

Experiences with SF and teaching science

Ideas for using SF as a teaching tool

Examples of SF use in the classroom

# Introduction--How does an SF writer get involved in science education?

- Continuity Editor: CPU project (Funded by NSF)
- Staff SF writer: CIPS project (Funded by NSF)
- Co-author/Co-editor: Science Comic (Funded by NASA/Hubble)

Hanny and the Mystery of the Voorwerp

# CPU Project

- Helping Laura deal with grad student workload
- Hired to clean up/unify voice of project
- Units written by 6 different authors
- That led to being hired for CIPS

# Staff Writer

- SF as part of original grant application
- Easier to put in grant than produce
- Develop SF world and characters for project
- Write short fiction to illustrate science concepts
- Working with academics



# CIPS project

Constructing Ideas in Physical Science

NSF-funded

Full year middle school curriculum

Research-based, student-centered

Scaffolded-inquiry pedagogy



# CIPS

- CIPS designed to use science fiction as a hook and as a teaching tool
- Created an SFnal world for project
- Short stories illustrating specific science
- 1,000 word short on speakers: 2 hour notice
  - Working with academics

# Storyline



Focus on 4 aliens from spaceship stranded in near-Earth space by catastrophic accident

Contact Earth to try to get help

Ship suffered extensive damage and now has problems with all on-board systems, especially power delivery

# CIPS Project Story

- Testing suggested increased engagement from low SES
- Initial printing included SF context
- Chronicles of Wandering Star
- Workbook/Illustrated Serial Novel  
Text book company ultimately removed SF



# Chronicles of the Wandering Star

**InterActions**  
IN  
PHYSICAL  
SCIENCE



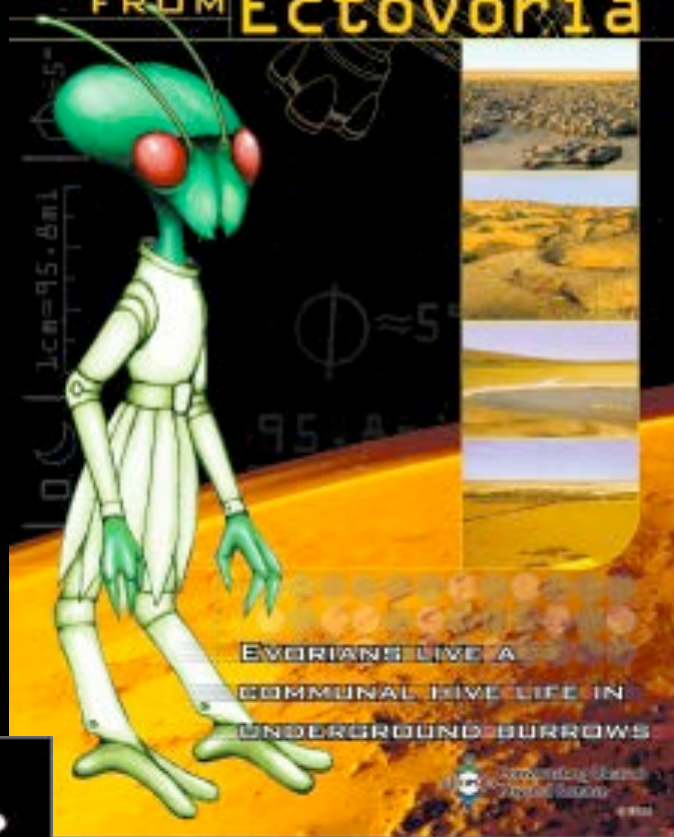
# CIPS Aliens

- CIPS Aliens
- Represent 4 modes of scientific thinking
  - Systems centered
  - Energy centered
  - Interactions centered
  - Forces centered



# Stas

FROM Ectovoria



EVORIANIS LIVE A COMMUNAL BIVE LIFE IN UNDERGROUND BURROWS

University of Illinois  
Chicago

# Modulas

FROM Structares

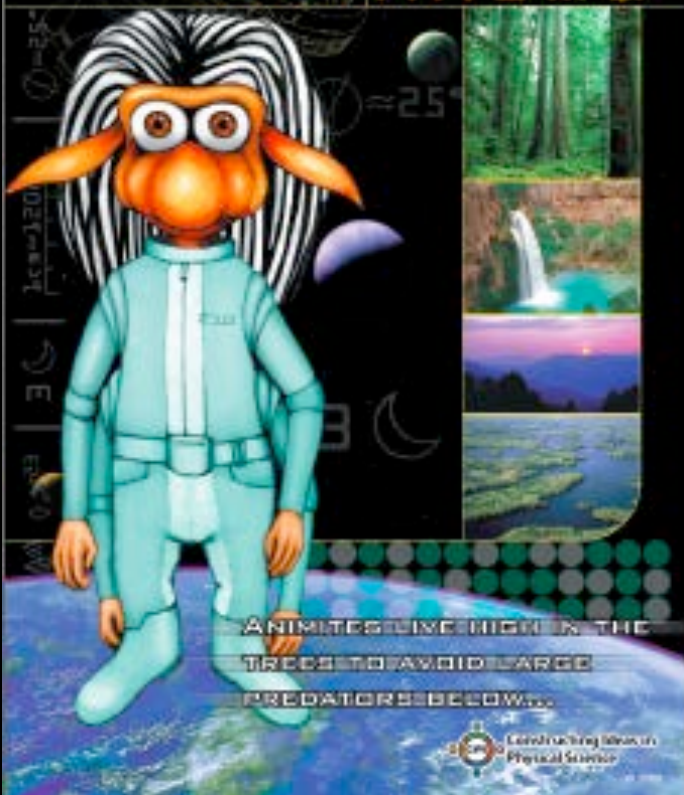


STRUCTARIANS LIVE DEEP UNDERGROUND IN CAVES FLOODED WITH ICE.

University of Illinois  
Chicago

# Kinet

FROM Anima



ANIMITES LIVE HIGH IN THE TREES TO AVOID LARGE PREDATORS BELOW...

University of Illinois  
Chicago

# Teract

FROM Sircos



SIRCOSITES BUILD THEIR HOMES BY TUNNELING INTO SEA CLIFFS.

University of Illinois  
Chicago

# One example

Is The Buzzing In My Ears Bothering You?

Modulas suit malfunction

Character development piece

Diagnosis and repair of suit

Ends with ship's buzzer - emergency

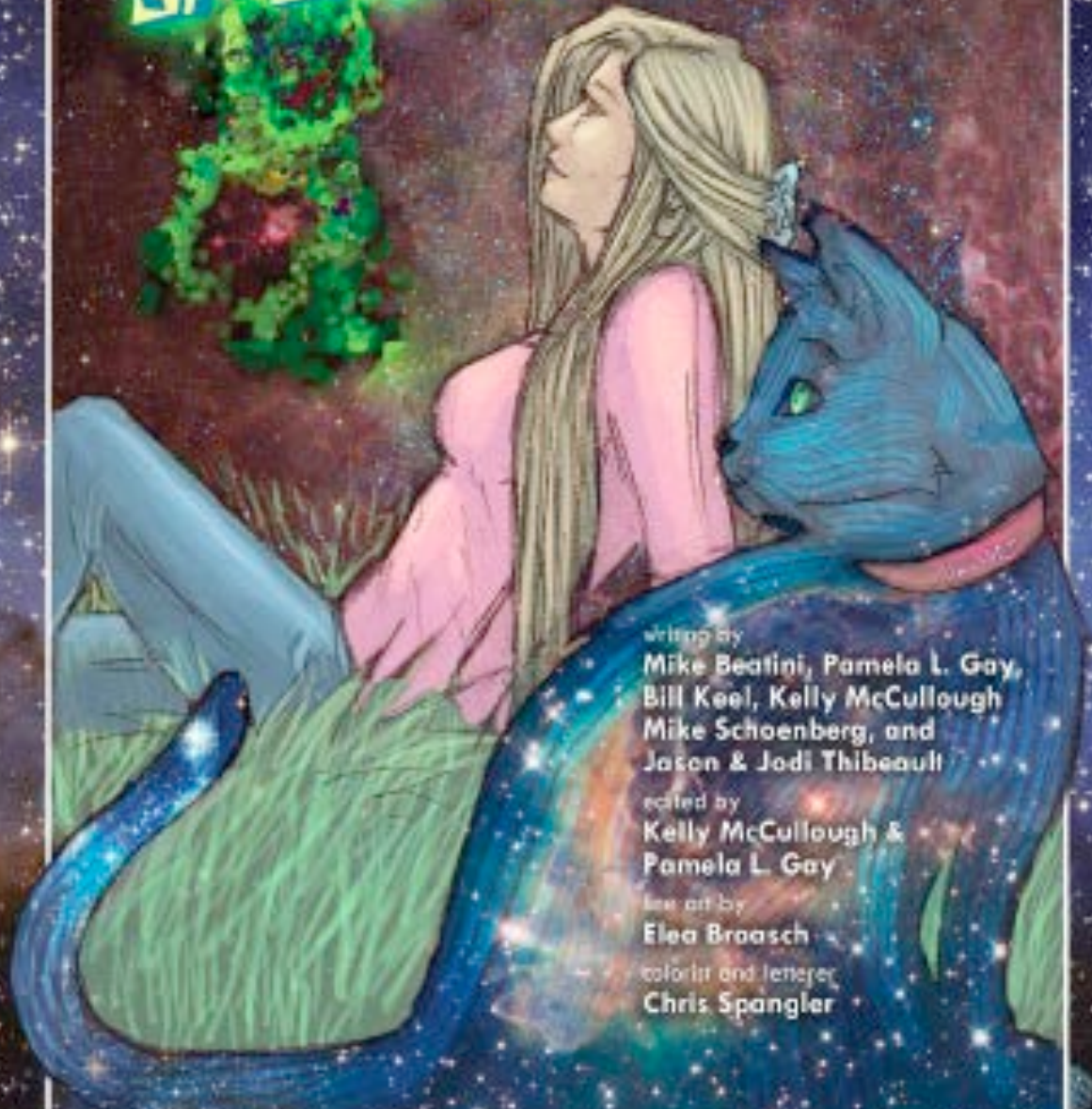
# Hanny & the graphic novel

- Approached by Pamela Gay, astronomer
- Citizen science—Galaxy Zoo
- Crowd-sourced classification of galaxies
- 2007—Hanny van Arkel (Dutch schoolteacher)
- Classifying galaxies for the project
- Strange colored blob of gas

- Hanny not first to see the blob
- First to ask about it
- Curiosity (this is important!)
- Evidence says quasar illuminating a gas cloud!
- Closest thing to actually seeing a quasar
- How to publicize/popularize information



# HANNY and the MYSTERY of the VOORWERP



written by  
Mike Beatini, Pamela L. Gay,  
Bill Keel, Kelly McCullough  
Mike Schoenberg, and  
Jason & Jodi Thibeault

edited by  
Kelly McCullough &  
Pamela L. Gay

ink art by  
Elea Braasch  
colorist and letterer  
Chris Spangler

A Project of the

**ZOONIVERSE**

<http://hannysvoorwerp.zooniverse.org>



# Creating the comic

- Storytelling as a way of garnering interest
- Crowd-sourcing comic itself
- Workshop at science fiction convention
- Divide up narrative
- Different writers
- Free PDF for download



THIS COMIC IS ITSELF A PART OF THE NARRATIVE OF OUR SCIENTIFIC STORY, AND THE PEOPLE WHO MADE IT ARE PART OF THE CAST OF VOORWERP SCIENCE. THEY ARE (CLOCKWISE STARTING IN THE UPPER LEFT): ELSA BRAUSCH, CHRIS SPANGLER, PAMBLA L. DAY, THE CAT CURIOUSITY / SCIENCE, MIKE BEATINI, MIKE SCHOENBERG, JODI & JASON THIBEAULT, AND KELLY MCCULLOUGH.

# My job

- Writing a few pieces
- Continuity editor (like CPU)
- Create an overarching narrative
- Character of cat science/curiosity  
(am I crazy)
- Curiosity as narrative hook
- Working with academics (astronomers!)





SCIENCE IS DRIVEN BY THAT MOST BASIC OF HUMAN IMPULSES, CURIOSITY.



WE WANT TO KNOW WHAT'S ON THE OTHER SIDE OF THE NEXT HILL....

OR INSIDE THIS SHELL.

OR HANGING IN THE SKY ABOVE US



THE STORY OF HANNY AND THE VOORWERP SPEAKS TO THAT LAST CURIOSITY: WHAT'S OUT THERE?



IT'S A STORY THAT STARTED LONG AGO WITH ANOTHER PROTAGONIST, STEPHANE JOUVELLE, AND THAT ENDS WITH AN AMAZING DISCOVERY USING ONE OF THE MOST SOPHISTICATED TOOLS EVER BUILT BY HUMAN HANDS, THE HUBBLE SPACE TELESCOPE

COME WITH ME AND SEE WHERE CURIOSITY CAN LEAD.



SCIENCE IS A PROCESS. IT'S DRIVEN BY CURIOSITY AS AN IDEA AND BY THE CURIOSITY OF THE MANY PEOPLE WHO ACTUALLY DO THE WORK AND LOOK FOR THE ANSWERS. BUT SCIENCE DOESN'T STOP WHEN WE FIND THOSE ANSWERS. AN IMPORTANT PART OF THE PROCESS IS SHARING WHAT WE'VE LEARNED WITH THE WORLD SO THAT WE CAN HELP OTHER PEOPLE SATISFY THEIR CURIOSITY AND MAYBE INSPIRE A NEW GENERATION OF SCIENTISTS. AND MAYBE SOMEDAY, ONE OF THOSE PEOPLE WILL BE YOU.

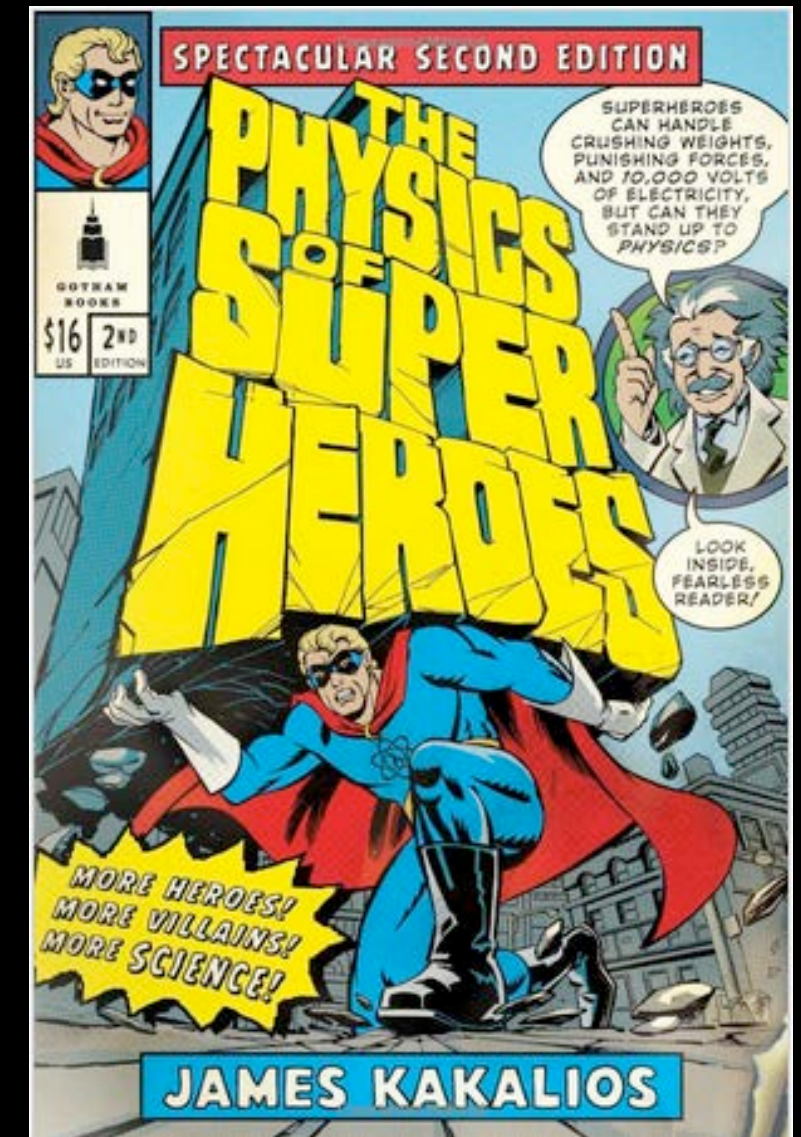
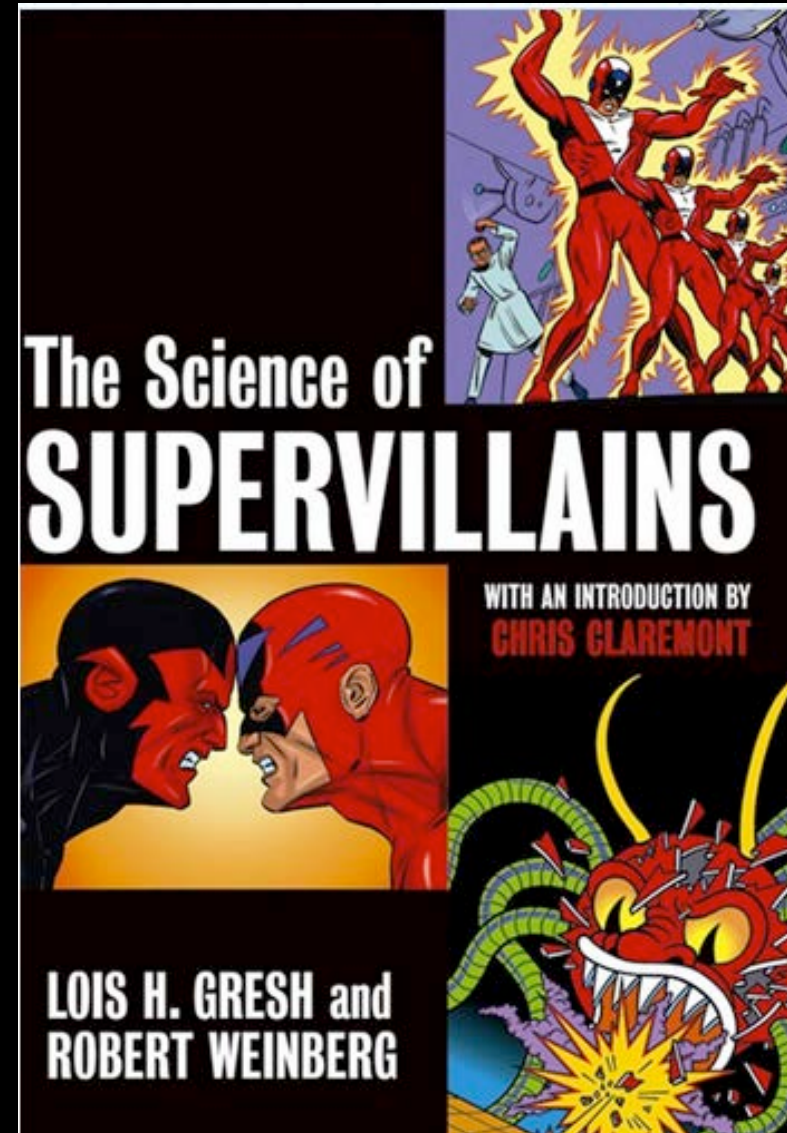
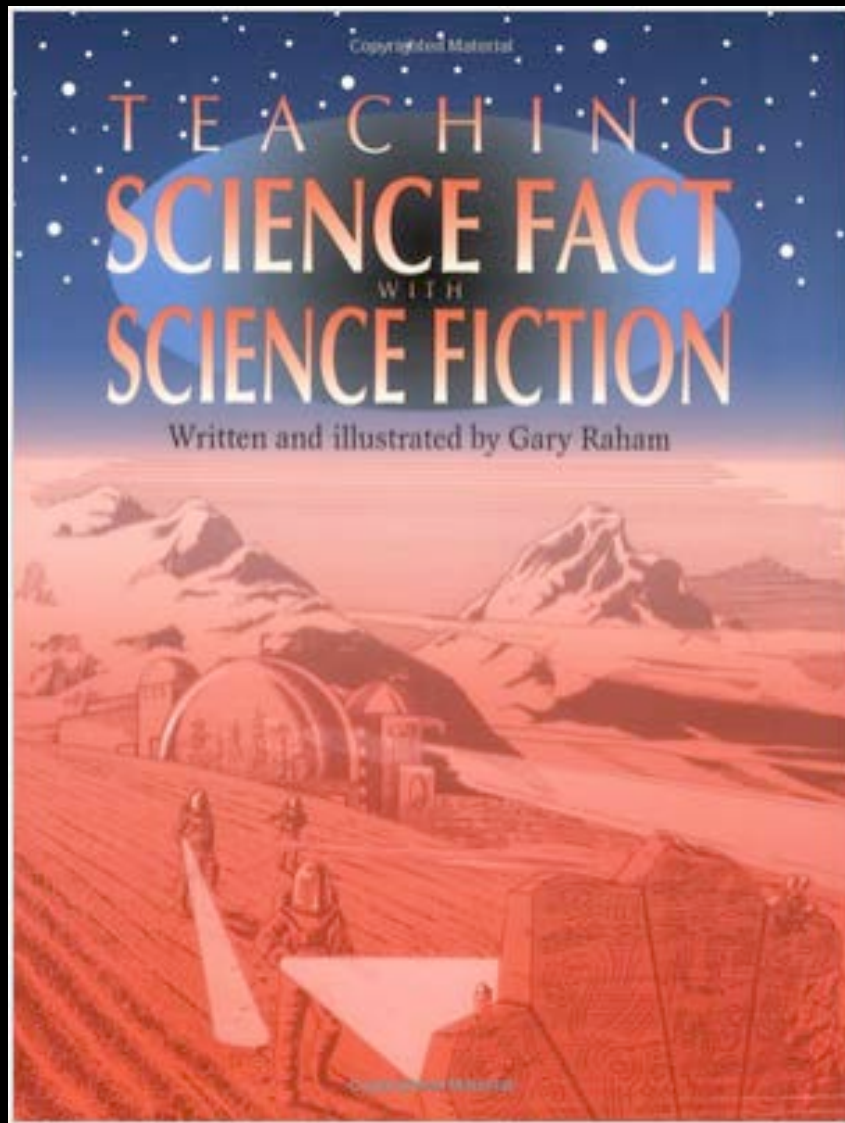


# SF in the classroom

- Idea has been around for a while
- The Physics Teacher 1968:  
“Try Science Fiction as a Teaching Aid”
- 10 other articles in TPT about science fiction and the classroom



# Books available



# SF shaping science

- Star Trek communicator
- Scientists who fell in love with science via SF
- New generations of writers falling in love with science and SF

# Reasons to use SF

- Teach science content
- Teach science language
- Teach science methods
- Model science culture
- Address reading/writing standards
- Hook an audience
- Build enthusiasm about science

# Ways to use SF

- Use extant SF (written/cinematic/games)
- Writing SF for the classroom
- Student writing of SF

# Using extant SF

- Readings in SF with good/bad examples
- Bad/good movie science—examine films
- Video games—content/physics engines
- Television—examine science/portrayal of scientists



# Insultingly Stupid Movie Physics

- [www.intuitor.com/moviephysics/](http://www.intuitor.com/moviephysics/)
- Movie physics rating system:
  - GP=good physics in general
  - PGP=pretty good physics
  - PGP13=children under 13 might be tricked into believing the physics
  - RP=retch
  - XP= obviously physics from an unknown universe

# SF written for the classroom

Written by SF authors to teach science

Often comes with teacher guides/resources

Tales from the Wonder Zone

Constructing Ideas in Physical Science

# Student writing

Assign SF writing to students

Final projects

In-class assignments

Assessments

Write SF story predicting technology

Write SF poem to test science vocabulary

Write SF story to complete idea

# Julie Czerneda

- Tales from the Wonder Zone
- Science Fiction Classroom Resources
- Why Use Science Fiction?



## Science Fiction in Education: Case studies from classroom implementations

Vrasidas, C., Theodoridou, K., Aravi,  
C., & Panaou, P



<http://www.scifiededucation.org>



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Communities/conferences dedicated to  
science education & science fiction



# Useful links

- <http://cpucips.sdsu.edu/web/cpu/default.html>
- <http://cpucips.sdsu.edu/web/cips/aliens.html>
- <http://www.galaxyzoo.org/>
- <http://hannysvoorwerp.zooniverse.org/>
- <http://www.scifieducation.org>

# Further Exploration I

- The Science of Science Fiction, Andrew Graham Phys. Teach. 40 , 255 (2002)
- Exploring the physics of science fiction, Ted Spickler Phys. Teach. 21 , 416 (1983)
- Science fiction aids science teaching, Leroy W. Dubeck, Matthew H. Bruce, Joseph S. Schmucker, Suzanne E. Moshier and Judith E. Boss Phys. Teach. 28 , 316 (1990)
- Using Science Fiction Movies in Introductory Physics, Marta L. Dark Phys. Teach. 43,
- Reaching Nonscience Students Through Science Fiction, Donald A. Smith Phys. Teach. 47, 302 (2009)

# Further Exploration II

- TPT NOTES: Try Science Fiction as a Teaching Aid, Isaac Asimov Phys. Teach. 6 , 416 (1968)
- Modern physics and science fiction A mini-unit for high school physics, Tom Southworth Phys. Teach. 25 , 90 (1987)
- Wizards, Aliens and Starships: Physics and Math in Fantasy and Science Fiction, John L. Hubisz Phys. Teach. 52 , 447 (2014) ; <http://dx.doi.org/10.1119/1.4895383>
- More than “Cool Science”: Science Fiction and Fact in the Classroom, Vandana Singh Phys. Teach. 52 , 106 (2014)

# Some Resources

- Astronomical Society of the Pacific releases updated resource guide to science fiction with good astronomy, Dan Maclsaac
- New Resource Guide for Teaching Astronomy Through Science Fiction, <http://www.astrosociety.org/education/resources/scifi.html>, Andrew Fraknoi and Andrew Graham  
Phys. Teach. 41 , 58 (2003)



- Thank you!

# More Student Writing

Final project option

Write a short story set in a near future

Revolves around new technology or product

What if - pick any SFnal what if

3 things that the “what if” would change

# Other art/science ideas

## Science songs

The Galaxy Song (Monty Python or Jim Post)

First and Second Law (Flanders & Swann)

NaCl song (Michael Cooney)

The Elements (Tom Lehrer)

The Physics Chanteuse (Lynda Williams)