

HOW IT WORKS

There is much evidence, anecdotal and research-based, that indicates that one-shot experiences do not provide ample conceptual change or knowledge gain. The workshops here are designed to be a series of experiences, based upon Georgia Performance Standards and others, that together through repeat and weekly visits cause the teachers to become knowledgeable and confident in their knowledge.

How The Workshops Are Arranged

1. An anonymous pre-visit content questionnaire and a survey to determine concerns and topics that you, the teachers, want to go over are sent in advance..
2. An appropriate set of lessons, covering 1-2 hours per day after-school, or more on 'off days,' is created. These include correcting misconceptions and pointing out (the numerous) textbook errors. All lessons are interactive, hands-on, full of content and useful pedagogy, with between visit assignments.
3. A post-visit questionnaire and certificate of attendance will be given to document learning and participation.

We will gladly come to your school to meet with you and discuss our workshops, to arrange visits and PLUs. Costs vary with time and numbers of teachers. An average after-school in-service of 90-120 minutes and <20 teachers begins at around \$200.

WHO IS DR. K?

DR. LARRY KRUMENAKER...

has been an astronomer, DeKalb County high school science teacher, college astronomy instructor (Agnes Scott College, Georgia Perimeter College, Mercer University) and planetarium instructor. His BS and MS astronomy degrees are from Case Western Reserve University, an MAT in Planetarium Education from Michigan State University, and Ph.D. in Science Education from the University of Georgia. His dissertation was a nationwide survey of high school astronomy courses and the effects of No Child Left Behind on them.



A well published author (*Astronomy Education Review*, *Science*, *Sky and Telescope*, and others), Dr. Krumenaker is the publisher/editor of *The Classroom Astronomer* magazine and author of the forthcoming book *To Teach The Stars*. He has been a speaker at such diverse meetings sites as the Southeastern Planetarium Association, AAPT, NSTA, GSTA, and the Hungarian Academy of Sciences.

Larry Krumenaker is an incredible resource. He provides everything one would want from an in-service workshop: depth of experience in his field, engaging as a presenter, flexible for and responsive to his audience.

I attended one of Larry's presentations at a GSTA regional conference. He showed me how to relate some of the more perplexing concepts of astronomy in ways my students easily grasped. Had I not been able to use Larry's experience to inform my teaching I would have wasted valuable time looking for the solutions he so clearly provided.

I highly recommend a "Larry" workshop for anyone interested in an efficient way to increase the content and pedagogical depth in the astronomy classroom. —Kevin McReynolds, high school science teacher, Winder, GA



Astronomy Workshops for Teachers —Content and Pedagogy

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WHY TEACH ASTRONOMY WELL?

Astronomy is the **most interdisciplinary** science, covering topics from physics to biology to chemistry, math to language to history. It is in our various **world cultures**, from the calendar to myths to today's **modern technology**. Kepler's 17th century laws of planetary motion govern GPS and communication satellites and your remote's infrared light was discovered by William Herschel, the discoverer of Uranus. In addition, astronomy is the rare science that even non-professionals can **make a contribution**, it can be a **life-long** hobby, and students always love to do things involving astronomy even in other classes and lessons. Knowledge of astronomy will help you understand more about science works.

Finally, teach astronomy because it is THE science that can **capture and inspire** nearly every child's interest and imagination. Even if astronomy isn't in your particular grade or course standards, it CAN be incorporated, to make students spark!



Dr. Larry Krumenaker's extensive background experience and expertise in astronomy, physical sciences, and science education was the backbone of our collaborative work with teachers and students at Taliaferro County K-12 school.... — Deborah J. Tippins, Ph.D., Professor of Science Education, University of Georgia

ASTRONOMY WORKSHOP OFFERINGS

THIS SET OF TOPICS IS A SAMPLING; LIKE THE UNIVERSE, TOPICS ARE UNLIMITED!
RED TITLES ARE POPULAR ONES!

THE SUN

Safe Observing, Sunspots, Sun Size – a Primer in Measuring, Effects on Earth – Magnetometers

THE MOON

Phases – Causes and Misconceptions
The Moon's surface during its phases - rotation
The Moon's surface – craters and Moon maps
Let's Bomb The Moon! - Analyzing crater shapes on the moon, creating a classification scheme, statistical description, then an inquiry-based lab

THE PLANETS

The Human Orrery, or Chaos Can Be Fun and Educational! — Learn about the orbits of the planets, Kepler's Laws, the Zodiac, retrograde motion, and the best time to see any planet, including that night, all in a large group exercise!

Categorizing – A science skill to use on planets
Heliocentric vs. Geocentric & Retrograde Motion—Ping Pong, Planets and History.

STARS

Star Distances and Lives of the Stars
The H-R diagram – A Jigsaw Look at Star Lives
Three Pieces of Data
Tell Us Everything



EARTH MOTIONS

What is the Cause of Summer Really? - A Modeling Exercise

Rotation, Revolution- units of time, The Zodiac

CONSTELLATIONS

Current Night Sky (we can do it real or simulated)
Star Legends (Cherokee, Hindi, and others)
Sky Maps and Body Angles

OTHER WORKSHOP OFFERINGS

PEDAGOGICAL INSIGHTS

Science is Tentative
Reasoning Skill processes

PHYSICS

Newton's Laws and the orbits and "weights" of planets
Spectroscopy without emission gas tubes
The Atomic Hotel—How atoms make spectra

MISCELLANEOUS/CROSS-CURRICULAR

How to Create, Insert, and Run Astronomy Courses in Your School (MS and HS)
How to Use a Telescope, Day or Night
Simple Uses for Statistics in Labs and Inquiry
How the Spectra of Street Lights Can Measure "Greenness" and Where Our Atoms Came From (connecting biology, chemistry, physics, and astronomy with environmental science!)

Dr. Krumenaker helped me to learn new information and to change some misconceptions that I had about topics relating to astronomy! His knowledge about astronomy and ideas about how to teach it make him an incredibly valuable resource. I would recommend Dr. Krumenaker and his services to any teacher who teaches astronomy at any level. — Lindsay Phillips, Fourth Grade Teacher, DeKalb County, Atlanta, GA

