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New Kind of Space-Time

Posted on **July 21, 2012**

Einstein explained that gravitation creates space-time curvature. But there is one important ingredient of that explanation: That space-time looks flat locally. Recent finding, however, shows that this is not always true.

In a Daily Galaxy's article we read about this new Singularity in Space-Time:

> *Mathematicians at UC Davis "…show that space-time cannot be locally flat at a point where two shock waves collide," said Blake Temple, professor of mathematics at UC Davis. "This is a new kind of singularity in general relativity."*

> *A singularity is a patch of space-time that cannot be made to look flat in any coordinate system, Temple said. One example of a singularity is inside a black hole, where the curvature of space becomes extreme.*

> *Temple and his collaborators study the mathematics of how shockwaves in a perfect fluid can affect the curvature of space-time in general relativity. In earlier work, Temple and collaborator Joel Smoller, the Lamberto Cesari professor of mathematics at the University of Michigan, produced a model for the biggest shockwave of all, created from the Big Bang when the universe burst into existence.*

*A shockwave creates an abrupt change, or discontinuity, in the pressure and density of a fluid, and this creates a jump in the curvature. But it has been known since the 1960s that the jump in curvature created by a single shock wave is not enough to rule out the locally flat nature of space-time.*Vogler's doctoral work used mathematics to simulate two shockwaves colliding, while Reintjes followed up with an analysis of the equations that describe what happens when shockwaves cross. He found this created a new type of singularity, which he dubbed a "regularity singularity."*

What is surprising is that something as mild as interacting waves could create something as extreme as a space-time singularity, Temple said.

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Science is A Game, but Life is Dead Serious

Posted on **July 19, 2012**

From CNN:

Using the Xbox to study locust swarms

Once upon a time, people thought that swarming creatures such as fish, bees and locusts communicated their movements by "thought transference," or telepathy.

Thanks in part to the work of Princeton ecologist Iain Couzin, now we know better. Couzin's lab is using computer-vision technology and even the Xbox's motion-sensing camera, called Kinect, to try to get a grip on how these creatures maintain their individually but also function so gracefully as a collective.

Among the lab's most surprising discoveries: Locusts in the western Sahara Desert swarm because they're trying to not to be eaten by their cannibalistic buddies.

> *"We just discovered by accident that the locusts were trying to eat each other," he said. "So when it looks like a cooperative swarm, in actual fact it's a selfish, sort of cannibalistic horde. Everyone is trying to eat everyone else and trying to avoid being eaten."*

Competition, cannibalism, and dog eat dog. Maybe it's not that bad? It is bad for individuals, but apparently it is quite useful for the those locusts swarm.

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It Takes a Better Telescope to Spot an Unseen Object

Posted on **July 18, 2012**

An article in Christian Science Monitor::

> ***Multi-telescope view two million times sharper than human eye reveals black hole***
>
> *Scientists using three telescopes spaced thousands of miles apart have caught the best look ever of the center of a distant quasar, an ultra-bright galaxy with a giant black hole at its core.*
>
> *By linking powerful radio telescopes in Chile, Arizona and Hawaii together, astronomers created a deep-space observing system with 2 million times sharper vision than the human eye, which gave them the most detailed direct view ever of a supermassive black hole inside a galaxy 5 billion light-years from Earth.*
>
> *"The shadow — a dark region seen against a brighter background — is caused by the bending of light by the black hole, and would be the first direct observational evidence for the existence of a black hole's event horizon, the boundary from within which not even light can escape," ESO officials said.*

Nothing can escape a black hole. Not even light. Physically speaking, we need light reflected from or emitted by an object in order for us to see that object. So, by definition we won't be able to see a black hole. However, the above article explains that at a certain distance from a black hole's event horizon, light is bended. This bending of light is an evidence for the existence of a black hole's event horizon. So we need light anyway, to see an object that light cannot escape from.

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