

Small bangs and white holes

May 23 2011, By Steve Nerlich



Gamma-ray bursts. We tend to think of them as big explosions - but it has been suggested that they might actually be Small Bangs. Credit: NASA.

Most gamma-ray bursts come in two flavors. Firstly, there are long duration bursts which form in dense star-forming regions and are associated with supernovae – which would understandably generate a sustained outburst of energy. The technical definition of a long duration gamma-ray burst is one that is more than two seconds in duration – but

bursts lasting over a minute are not unusual.

Short duration gamma-ray bursts more often occur in regions of low star formation and are not associated with supernovae. Their duration is technically less than 2 seconds, but a duration of only a few milliseconds is not unusual. These are assumed to result from collisions between massive compact objects – perhaps neutron stars or black holes – producing a short, sharp outburst of energy.

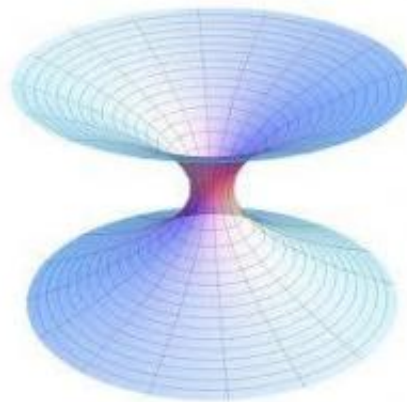
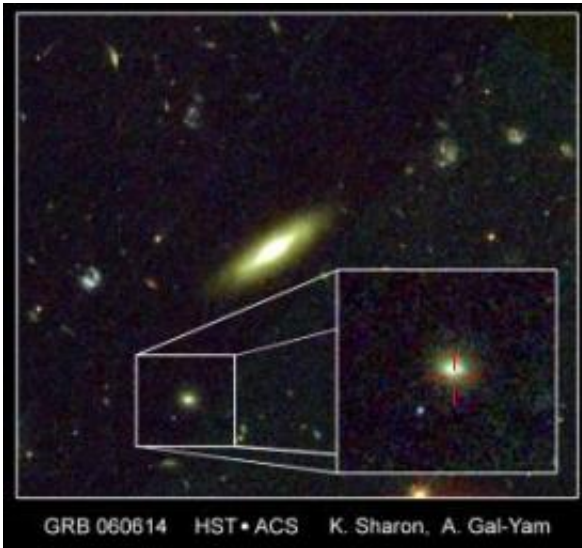
But there are also rare instances of gamma-ray bursts that don't really fill either category. GRB 060614 is such a beast – and has been referred to as a hybrid burst. It had a long duration (102 seconds) but was not associated with a supernova. This finding was significant enough to warrant an [article in *Nature*](#) – with the lead author Gehrels stating "This is brand new territory; we have no theories to guide us."

We should be grateful that no-one decided to call it a dark burst. And we are yet to see another such confirmed hybrid [gamma-ray burst](#) that might verify whether these are hybrid bursts are really something extraordinary.

Nonetheless, [Retter and Heller have suggested](#) we should consider the possibility that GRB 060614 might have been a white hole. A white hole is a theoretical entity – and arguably just an artifact of the mathematics of general relativity. Assuming a black hole is an object from which nothing can escape – then its symmetrical opposite would be a white hole into which nothing can enter – but which can radiate light and from which matter can and does escape.

Arguably the whole idea just arises because general relativity abhors sharp edges. So the argument goes that the space-time continuum should ideally extend indefinitely – being curved by massive objects, but never brought to an edge. However, [black holes](#) represent a pinch in space-

time where everything is supposedly dragged into a point-like singularity. So, one solution to this problem is to suggest that a black hole is not an interruption to the continuum, but instead the space-time around a black hole is drawn into a narrow-necked funnel – essentially a wormhole – which then feeds through to a white hole somewhere else.



Left image: The mysterious hybrid gamma ray burst GRB 060614. Right image: The 'what goes in must come out' model of white holes - where a black hole is connected to a white hole - and the white hole is time-reversed so that it expels material in the past. This was initially proposed as a solution to explain quasars in the early universe, but better explanations have come along since (e.g. supermassive black holes with jets).

Being opposites, a black hole in the present would be connected to a white hole in the past – perhaps a white hole that existed in the early universe, emitting light and matter for a period and then exploding – kind of like a film of the formation of a black hole run backwards. It's been suggested that such white holes might have created the first anisotropies in the early isotropic universe – creating the 'clumpiness'

that later led to galaxies and galaxy clusters.

Alternatively, the Big Bang might be seen as the ultimate white hole which expelled a huge amount of mass/energy in one go – and any subsequent white holes might then be ‘lagging cores’ or Small Bangs.

There are substantial theoretical problems with white hole physics though – for example, the matter it ejects should immediately collapse back down on itself through self-gravity – meaning it just becomes a black hole anyway, or perhaps it explodes. If the latter possibility is correct, maybe this is one possible explanation of GRB 060614 seen back in 2006. But it’s probably best to wait for another hybrid burst to appear and get some more data before getting too carried away here.

Source: [Universe Today](#)

Citation: Small bangs and white holes (2011, May 23) retrieved 20 March 2024 from <https://phys.org/news/2011-05-small-white-holes.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--