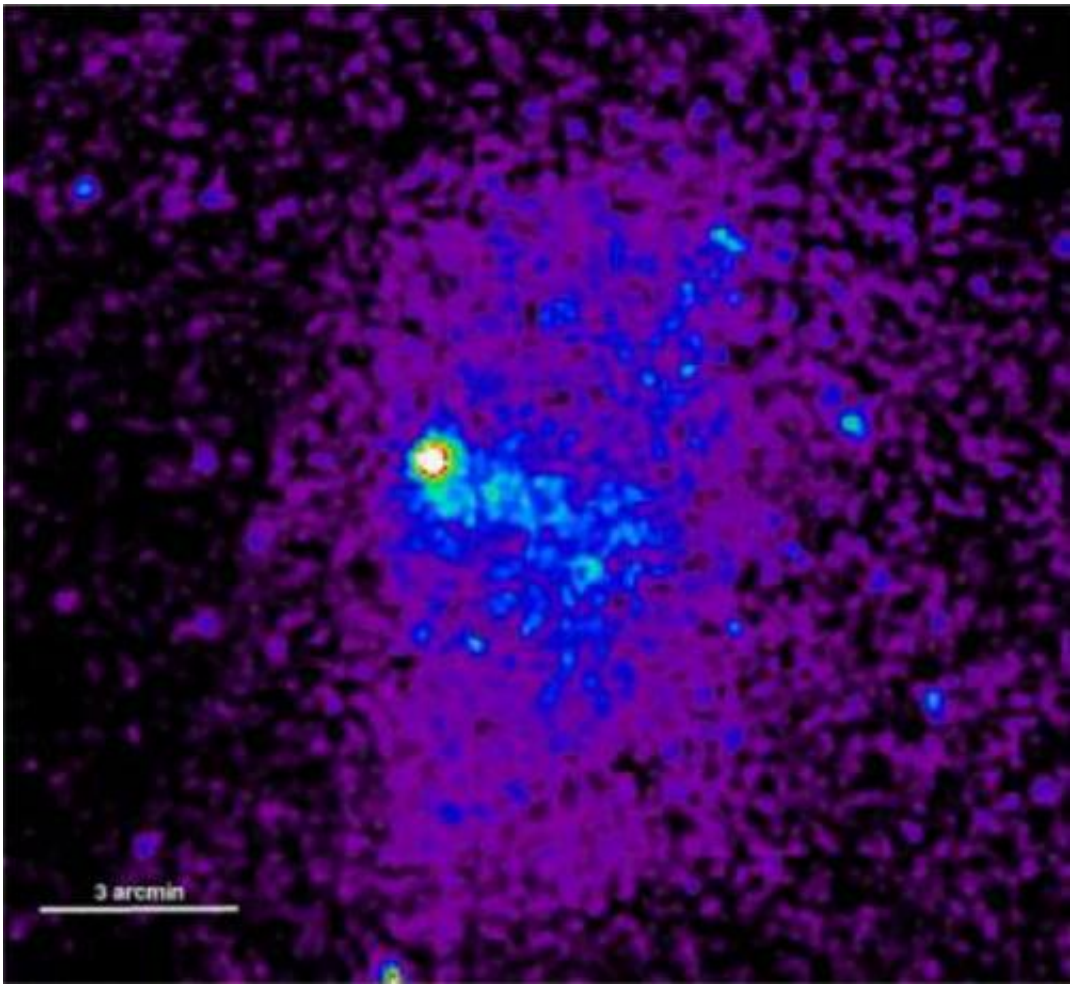
Speeding bullet galaxy observed slamming into galaxy cluster

January 16 2015, by Bob Yirka



XMM-Newton flux image of RXCJ2359.3-6042. All three detectors were combined after the exposure correction in the [0.5-2.0] keV band. A scale of three arcmin is shown with a bar. Credit: arXiv:1501.02371 [astro-ph.GA]

(Phys.org)—Researchers working at Europe's XMM-Newton X-ray space telescope have observed a speeding galaxy smashing its way through a galaxy cluster called Abell 4067. They have reported their observations and findings in a paper uploaded to the *arXiv* server, soon to be published in the journal *Astronomy & Astrophysics*.

Scientists have observed a galaxy smashing into another one before—back in 2008 such an event was seen and provided what many have called proof of the existence of dark matter. The speeding galaxy left behind a gas trail, while evidence of something else clearly left a trail veering off in a different direction. The observation also added credence to the theory that dark matter exists in a ring around most galaxies.

The more recent collision occurred approximately 1.4 billion light years away—the bullet, the team reports, was traveling at approximately 814 miles per second and survived. Such impacts allow researchers both beautiful imagery and a trove of data—they allow for the bullet galaxy to have its mass measured, for example. This latest one weighed 200 trillion time as much as planet Earth. It also allows space scientists to view firsthand what goes on when such events occur, letting them see what actually happens to both the bullet and the cluster. The researchers note that because this most recent collision was much slower than the prior event, and because it was smaller, it was much more difficult to calculate the mass of the bullet. The researchers came across the collision as they were conducting a survey of distant galaxy clusters. It has been noted that the Milky Way galaxy will be one day serving as a similar bullet, smashing into the Andromeda galaxy approximately four billion years from now.

The researchers plan to continue studying the bullet and collision (they have just been given the go-ahead to engage in a deeper observation event by the telescope operators) hoping to learn more about how

galaxies behave in general, particularly when under stress. More observations should reveal, for example, how much gas surrounds the speeding galaxy along with data about the shock wave. There is also of course, a chance that it could lead to a better understanding of dark matter.

More information: Witnessing a merging bullet being stripped in the galaxy cluster, RXCJ2359.3-6042, arXiv:1501.02371 [astro-ph.GA] arxiv.org/abs/1501.02371

Abstract
We report the discovery of the merging cluster, RXCJ2359.3-6042, from the REFLEX II cluster survey and present our results from all three detectors combined in the imaging and spectral analysis of the XMM-Newton data. Also known as Abell 4067, this is a unique system, where a compact bullet penetrates an extended, low density cluster at redshift z=0.099 clearly seen from our follow-up XMM-Newton observation. The bullet goes right through the central region of the cluster without being disrupted and we can clearly watch the process how the bullet component is stripped of its layers outside the core. There is an indication of a shock heated region in the East of the cluster with a higher temperature. The bulk temperature of the cluster is about 3.12 keV implying a lower mass system. Spearheading the bullet is a cool core centred by a massive early type galaxy. The temperatures and metallicities of a few regions in the cluster derived from the spectral analysis supports our conjecture based on the surface brightness image that a much colder compact component at 1.55 keV with large metallicity (0.75 Zsol) penetrates the main cluster, where the core of the infalling component survived the merger leaving stripped gas behind at the centre of the main cluster. We also give an estimate of the total mass within r500, which is about 2e14Msol from the deprojected spherical-beta modelling of the cluster in good agreement with other mass estimates from the M—Tx and M-sigma_v relations.

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