Temat: GERG-D-18-00302R1 - Your Submission

Nadawca: "GERG Editorial Office (GERG)" ¡em@editorialmanager.com¿

Data: 2018-11-28 21:31

Adresat: "Andrzej Krasinski" ¡akr@camk.edu.pl¿

Ref.: Ms. No. GERG-D-18-00302R1 Short-lived flashes of gamma radiation in a quasi-spherical Szekeres metric General Relativity and Gravitation

Dear Prof. Dr. Krasinski,

Reviewer comments on your work have now been received. In view of the report and the recommendation of the Associate Editor who handled the paper I regret to inform you that your submission is not suitable for publication in GERG.

The reviewer comments can be found at the end of this email or can be accessed by following the provided link.

Thank you for your interest in GERG.

Yours sincerely

Roy Maartens

Editor-in-Chief

General Relativity and Gravitation

Reviewer comments:

Associate editor:

For the revised version we were able to obtain the help of a leading figure in relativistic astrophysics as the second reviewer.

As a supporter of investigation of alternative cosmological models, I was pleased the first reviewer did not include any criticisms based on that issue but focused his attention, in reading the revised version, on issues similar to the second reviewer, namely whether the resulting light received from the proposed mechanism could account for the observed gamma rays.

Both reviewers conclude that as the paper stands it does not succeed in that respect. The first reviewer says the calculations are correct. The second states that a paper that overcame the points stated at the end of the report would be well worth publishing. It may thus be possible for the author, with further work, to write an acceptable paper based on these ideas but it seems the present version should be rejected. I regret that conclusion as I am well aware the author has been a real leader in our general field and has in particular done excellent work for our journal, but it seems unavoidable.

Reviewer #1:

I have carefully read the author's response letter and checked if it contains anything that could change my recommendation that the paper be rejected. To begin with, let me emphasise that I am, of course, not of the opinion "that investigating models that do not agree with the current astrophysical paradigm should be prohibited". A certain part of my own work is on "alternative theories" off the main stream. But I do think that it is part of my task as a referee to check if what an author suggests is in contradiction with observations. In the case at hand, unfortunately, I have come to the conclusion that this is the case and the more I thought about the matter the more arguments I found. In my first report I had given (essentially) two arguments. In response to the author's reply, I reconsidered these arguments again, see items (i) and (ii) below, and I still believe that they are valid. In addition, I give two more arguments, see items (iii)

and (iv) below, which have come to my mind only now. All four arguments together give overwhelming evidence, in my view, that the observed gamma ray bursts have nothing to do with the mechanism suggested in this paper.

(i) I had said that gamma ray bursts could not be associated with galaxies if they are produced in the way the author suggests. However, observers claim that they are. I looked up the literature for quantifying this claim. I found a paper by M. A. Campisi and L.-X. Li [Probability for chance coincidence of a gamma-ray burst with a galaxy on the sky, Mon. Not. Roy. Astr. Soc. 391, 935 (2008)] who come to the conclusion that, even for high-redshift gamma ray bursts of z greater than or approximately equal to 3, the probability for chance coincidence is only 3 percent; for lower redshifts it is of course significantly smaller. So this already excludes the mechanism suggested in this paper for a great majority of gamma ray bursts. In addition, we observe (spectroscopic) redshifts for many gamma ray bursts which is further convincing evidence against the model suggested here. In his response letter the author essentially admits that this is true: His mechanism is definitely excluded for a great majority of gamma ray bursts. He says that they could sit only in the gap between "almost all" and "all". This is absolutely not what he says in the paper! The paper gives the impression that he presents a viable model for ALL gamma ray bursts.

(ii) I had said that one would have to explain the energy (apparently) associated with gamma ray bursts. It seems that the author misunderstood this comment because his answer doesn't address the point I meant. So let me explain this again. When we receive a gamma ray burst we can measure the energy (frequency) of the individual photons and the number flux of photons. Both things together give the energy flux (i.e., energy per time per area). If calculated on the basis of the standard theory, this leads to the conclusion that the energy produced in a gamma ray burst is very big, namely of the order of 10^{44} Joules at least. Now the author suggests that, actually gamma ray bursts are produced at a much earlier stage of the universe (i.e., much farther away from us) than assumed in the standard theory and that they have nothing to do with high-energy explosions. The only way in which, on the basis of this assumption, the observed number flux could be understood is by a focussing mechanism: The spacetime geometry would have to focus photons that have been produced in a very big spacetime region onto a small detector surface. I cannot see any explanation, or even an attempt of such an explanation, in the author's work on how the observed number fluxes could come about.

(iii) There is another point which, strangely enough, had escaped me in the first round: If the radiation of gamma ray bursts is just frequency-shifted CMB, then it should show a Planck spectrum. This follows from the fact that the frequency shift, in the author's model, just comes from the spacetime geometry and is, thus, the same for photons of all frequencies. Clearly, if one applies such a constant frequency shift to a Planck spectrum one gets again a Planck spectrum (with a different temperature, of course). According to the author's theory this should apply to the burst itself and to the afterglow. But this is not what is observed! The observed spectra of gamma ray bursts differ significantly from a Planck spectrum. This clearly shows that they cannot be frequency-shifted cosmic microwave background radiation.

(iv) Another argument came to my mind when I read in the author's response letter the sentence: "The *observed* GRBs DO perturb the isotropy of the CMB: for the

time when a gamma-flash is visible it blacks out the CMB rays within the image of the gamma-ray source." This is absolutely NOT what is observed. Nobody has ever seen that part of the CMB is blacked out during a gamma-ray burst. Let us recall that the CMB and a gamma ray burst cannot be observed simultaneously with the same instrument: The CMB is observed with radio telescopes; it cannot be seen with gamma-ray detectors. By contrast, gamma ray bursts are seen only with gamma ray detectors. (Some of them have afterglows that can be seen in the radio range, but a burst itself has never been seen with a radio telescope.) So when a gamma ray burst goes off in the sky it is observed with gamma ray detectors but nothing happens to the CMB. This is naturally understood in the standard theory, according to which gamma ray bursts have nothing to do with the CMB. In the author's theory, however, part of the CMB should, indeed, be blacked out for the duration of the gamma ray burst because the corresponding radiation is shifted out of the frequency range for which radio telescopes are sensitive. The author writes that his bursts cover an area with an angular diameter of about 2 degrees in the sky, and that he hopes to reduce this to 1 degree in a refined model. The Planck instrument had an angular resolution of 5 arcminutes and also for WMAP it was well below 1 degree. I do not know the temporal resolution of the raw data taken by these instruments, but generically radio telescopes can respond to temporal variations within fractions of a second. So I believe that such black-outs in the CMB would have long been observed if they had actually happened. Of course, one should ask an observer for confirmation.

The author says that he would "appreciate hints on which paragraphs or sentences or words in the paper should go away in order to make it less outrageous." As explained in items (i) to (iv) above, I firmly believe that the model suggested for gamma ray bursts in this paper is just in contradiction with the facts. And if the idea of explaining the observed gamma ray bursts in the way suggested is dropped, the paper is without any motivation: Considering this very special combination of quasi-spherical Szekeres regions is motivated only by the desire to mimic the observed gamma ray bursts. At least, I cannot see any other motivation. If the author could give some other motivation, the paper should indeed be reconsidered; as I said before, I believe that the calculations are correct. As long as such a motivation is missing, however, I have to recommend that the paper be rejected.

Reviewer #2:

The paper comes for review along with the correspondence between the author and the previous referee. The first referee made very clear statements and I fully agree with his opinion.

The paper deals with the effect of light blueshift due to strong inhomogeneities in metric. In the series of papers the author proposes to explain cosmological gamma-ray bursts (GRBs) via this effect, modeled by incorporating in the Friedmann universe regions of spacetime described by the Szekeres metric. It is shown that light emitted in these regions in certain circumstances will be blueshifted. The proposed source of light is the recombination of primeval plasma (hydrogen and helium). Parameters of the model are found numerically in order to describe the blueshift of the light to such extent, that it will be detected in gamma-ray part of the spectrum. The present paper attempts to explain the observed duration of GRBs by the propagation of light in another region

described by Szekeres metric, which causes time-dependent deflection of the light ray and consequently disappearance of the source, from the viewpoint of an observer, after some time. Parameters of the model are found numerically which should reproduce typical duration of long GRBs.

The effect of inhomogeneities on the propagation of light is very important and timely to study. In particular, light propagation in Szekeres metric is one of the active fields of research. Nevertheless, the proposal to explain GRBs with such effect are not grounded enough to be considered seriously. In fact, any successful model of GRBs must explain not just three facts acknowledged by the author: 1) that these are actually gamma-rays; 2) that they have cosmological redshifts about 1; 2) that the typical burst (actually, just part of it, namely its prompt emission episode) lasts tens to hundreds of seconds.

The viable model of GRBs should explain the entire spectrum of the emission and its time dependence: broad-band emission within radio, optical, UV, X-ray, MeV to GeV bands. Non-thermal shape of the spectrum as well as the presence of different spectral components, such as thermal ones. Time sequence of the prompt emission, early irregular afterglow with possible flares and the smooth late afterglow. The supernova-GRB association, as well as the connection to different host galaxies of different types of GRBs. One may list many other essential properties of GRBs necessary to be explained by a successful model.

In addition, mechanism of recombination in inhomogeneous universe, which is the essence of the proposed mechanism, should be considered in details before the claim that such mechanism can be responsible for observed gamma-ray emission is made. It is quite possible that such a mechanism would be very different from the usual recombination in homogeneous isotropic Friedmann models, due to strong inhomogeneity.

In conclusion, in the present paper the author shows "by numerical calculation, in an exemplary QSS configuration, that the gamma-ray bundle will no longer be visible to the present observer after 10 minutes; instead she will see UV rays coming from the same direction". This exemplary numerical calculation evidently (by the choice of the corresponding parameters) supports his previous claim about the origin of GRBs from light propagation in inhomogeneous regions of spacetime described by Szekeres metric, c.f. Phys. Rev. D.93 (2016) 043525. As such, this is just a numerical example and it does not appear to be important enough to deserve publication. What the author should demonstrate, is that the effect is general enough, does not require any fine-tuning, and does not contradict other relevant cosmological data, in particular observed temperature and polarization of the cosmic microwave background. In such case the work will certainly be important enough for the publication.