

Piercing of domain walls: new mechanism of gravitational radiation

Dmitri Gal'tsov,^{a,b} Elena Melkumova^a and Pavel Spirin^a

^a*Faculty of Physics, Moscow State University,
119991, Moscow, Russian Federation*

^b*Kazan Federal University,
420008, Kazan, Russian Federation*

E-mail: galtsov@phys.msu.ru, elenamelk@mail.ru, pspirin@physics.uoc.gr

ABSTRACT: Domain wall (DW) moving in media undergoes the friction force due to particle scattering. However certain particles are not scattered, but perforate the wall. As a result, the wall gets excited in the form of the branon wave, while the particle experiences an acceleration jump. This gives rise to generation of gravitational waves which we call “piercing gravitational radiation” (PGR). Though this effect is of higher order in the gravitational constant than the quadrupole radiation from the collapsing DWs, its amplitude is enhanced in the case of relativistic particles or photons because of absence of the velocity factor which is present in the quadrupole formula. We derive the spectral-angular distribution of PGR within the simplified model of the weakly gravitating particle-wall system in Minkowski space-time of arbitrary dimensions. Within this model the radiation amplitude is obtained analytically. The spectral-angular distribution of PGR in such an approach suffers from infrared and ultraviolet divergences as well as from collinear divergence in the case of a massless perforating particle. Different cut-off schemes appropriate in various dimensions are discussed. Our results are applicable both to cosmological DWs and to the braneworld models. PGR can be relevant in the infrared part of the spectrum of the relic gravitons where radiation from the collapsed DWs is damped.

KEYWORDS: Classical Theories of Gravity, Black Holes, Brane Dynamics in Gauge Theories, Large Extra Dimensions

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