Title:	Infrared signatures of a quantum bounce in a minisuperspace analysis of Lemaître-Tolman-Bondi dust collapse
Authors:	Sahota, Harkirat Singh (/jspui/browse?type=author&value=Sahota%2C+Harkirat+Singh) Lochan, Kinjalk (/jspui/browse?type=author&value=Lochan%2C+Kinjalk)
Keywords:	Quantum gravity Canonical quantum gravity
Issue Date:	2021
Publisher:	American Physical Society
Citation:	Physical Review D, 104(12).
Abstract:	Mode decomposition is crucial for studying the dynamics of propagation in a quantum process. In the quantum treatment of collapsing matter, a viable mode analysis is supposed to give information regarding emission during the collapse. Nevertheless, partly owing to operator ordering ambiguities involved in a typical quantum gravity analysis, the availability of such well-defined modes is not guaranteed. We study the mode decomposition of the unitarily evolving wave packet constructed for the quantum model of spherically symmetric dust collapsing in a marginally bound Lemaître-Tolman-Bondi (LTB) model. We consider a minisuperspace model of dust collapse, where black hole singularity is replaced by a bounce from collapsing phase to expanding phase in the quantum dynamics of the dust cloud. We identify the observable depicting mode decomposition, and using the freedom of operator ordering ambiguity, we obtain the Hermitian extension of this operator alongside the Hermitian Hamiltonian. After identifying incoming and outgoing modes with this operator's eigenstates, we estimate their contributions to the radiation profile. True to a quantum description, the expanding and contracting branches do not entirely comprise of outgoing and incoming radiation. The infrared sector of this process demonstrates some characteristic features which turn out to be highly sensitive to the near-bounce dynamics of the dust cloud. Near the epoch of classical singularity, there is a significant contribution from incoming/outgoing modes of small wave number in the expanding/collapsing phase of the dust cloud, which keeps on decreasing as one moves away from the singularity. The information of the bounce is carried over to the infrared modes through a flip from largely incoming to largely outgoing radiation as the evolution progresses from collapsing to expanding phase, much before the information of bounce comes about to any observer. In the infrared sector, the saturation value of the amplitude marks the bounce radius. Thus, we argue that the information of the short scale physics is essentially carried over to the longest wavelength in this quantum gravity model, which we argue is rather more prominent for low energy processes.
Description:	Only IISERM authors are available in the record
URI:	https://doi.org/10.1103/PhysRevD.104.126027 (https://doi.org/10.1103/PhysRevD.104.126027) http://hdl.handle.net/123456789/4611 (http://hdl.handle.net/123456789/4611)
Appears in Collections:	Research Articles (/jspui/handle/123456789/9)

Need To Add…Full Text_PDF. (/jspui/bitstream/123456789/4611/1/Need%20To%20Add%e2%80%a6Full%20Text_PDF.)	15.36 kB	Unknown	View/Open (/jspui/b

Show full item record (/jspui/handle/123456789/4611?mode=full)

(/jspui/handle/123456789/4611/statistics)