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Radiation enhancement and "temperature" in the collapse regime of gravitational scattering

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We generalize the semiclassical treatment of graviton radiation to gravitational scattering at very large energies $\sqrt{s} \gg m_P$ and finite scattering angles Θ_s, so as to approach the collapse regime of impact parameters $b \simeq b_c \sim R \equiv 2G\sqrt{s}$. Our basic tool is the extension of the recently proposed, unified form of radiation to the string-based ACV reduced-action model and to its resummed-eikonal exchange. By superimposing that radiation all-over eikonal scattering, we are able to derive the corresponding (unitary) coherent-state operator. The resulting graviton spectrum, tuned on the gravitational radius R, fully agrees with previous calculations for small angles $\Theta_s \ll 1$ but, for sizeable angles $\Theta_s(b) \leq \Theta_c = O(1)$ acquires an exponential cutoff of the large ωR region, due to energy conservation, so as to emit a finite fraction of the total energy. In the approach-to-collapse regime of $b \to b_c^+$ we find a radiation enhancement due to large tidal forces, so that the whole energy is radiated off, with a large multiplicity $\langle N \rangle \sim Gs \gg 1$ and a well-defined frequency cutoff of order R^{-1}. The latter corresponds to the Hawking temperature for a black hole of mass notably smaller than $\sqrt{s}$.
I shall also show preliminary results for collisions below the critical impact parameter ($b < b_c$) where a classical collapse is expected, but a quantum-mechanical mechanism can avoid or reduce information loss.

Experimental Collaboration

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