Abstract

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We study the quantum mechanics of homogeneous black hole interiors in the RST model of 2D gravity. The model, which contains a dilaton and metric, includes radiation back-reaction terms and is exactly solvable classically. The reduced phase space is four dimensional. The equations for one pair of variables can be trivially solved. The dynamics of the remaining degree of freedom, namely the dilaton, is more interesting and corresponds to that of a particle on the half line in a linear potential with time dependent coupling. We construct the self-adjoint extension of the corresponding quantized Hamiltonian and numerically solve the time dependent Schrodinger equation for Gaussian initial data. As expected the singularity is resolved and the expectation value of the dilaton oscillates between a minimum and maximum, which both gradually decrease with time due to the time dependence in the potential. In the classical black hole spacetime, the maximum value of the dilaton corresponds to the size of the horizon while the minimum is the singularity. The quantum dynamics, therefore, corresponds at the semi-classical level to an evaporating black hole. The rate of quantum fluctuations increases as the system evolves but intriguingly, at longer times the expectation value of the radius undergoes "revivals" in which the amplitude of oscillations between minimum and maximum temporarily increases. These revivals are also characteristic of the quantum dynamics of the *time independent* quantum linear potential.